ENGINEERING NEWS

AND

AMERICAN RAILWAY JOURNAL.

Vol. XXIII. No. 21.

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ENGINEERING NEWS.

THE NET EARNINGS OF UNITED STATES RAILWAYS for the month of March and for the first three months of 1890 show a favorable increase over the corresponding periods of 1889. According to statistics collected by the *Financial Chronicle*, the gross and net earnings of 124 railways for March and of 149 railways for three months compare as follows, with last year's earnings:

	1890.	1889.
	March.	
Gross	$50,022,508	$44,985,561
Net	15,510,037	14,238,219
	Three months.	
Gross	$166,628,417	$151,706,160
Net	49,117,906	43,528,074

This gives a gain of 8.93 per cent. over last year for March and a gain of 12.84 per cent. for three months. The Southwestern roads show the greatest increase for both March and the three months—54 per cent. and 41 per cent. respectively. The Northwestern, Eastern and Middle, and Trunk lines follow with 21 and 27 per cent., 7 and 23 per cent., and 8 and 16 per cent., respectively. The Southern roads show an increase of 9 per cent. for three months and a decrease of 7 per cent. for March. The Pacific roads show a decrease of 11 per cent. for three months and an increase of 1 per cent. for March. The decrease in both cases is due to adverse weather. Taken as a whole, however, the condition of the railway transportation business is very favorable.

THE BROOKLYN ELEVATED R. R. CO. reports an increase of earnings in the first quarter of 1890 over the same period of 1889 of 66%, or from $241,531 to $337,210. Expenses increased, 51%.

THE ATCHISON, TOPEKA & SANTA FE R. R. CO. is reported to have secured control of the St. Louis & San Francisco Ry. by purchase. The terms of the purchase are not definitely known. This movement gives the Atchison company absolute control of the Atlantic & Pacific Ry., which, since 1886, has been under the joint control of the Atchison and the St. Louis & San Francisco companies, and furnishes it with an outlet to New Mexico and the Southwest.

FOR THE INTERCONTINENTAL RAILWAY SURVEY Congress is asked to appropriate $65,000 by Secretary of State BLAINE. Mr. BLAINE approves of this first outcome of the Pan American conference and proposes that the amount named be put at the disposal of an international commission as the share of the United States towards ascertaining the best and most economical route for connecting existing lines and surveys between South and Central American countries. Three commissioners will be required on the part of the United States. President HARRISON, in forwarding this letter, approves of its general provisions, and while stating that the work contemplated is vast, he believes it to be entirely practicable. He recommends Congress to make the appropriation and to authorize the appointment of commissioners and engineers.

CHIGNECTO SHIP RAILWAY is steadily progressing toward completion. The total length is 17 miles, and 14 miles of this have been graded. All the rails have been delivered, most of the hydraulic machinery is on the ground, and the masonry of the lifting docks is well advanced. The rails weigh 110 lbs. per yard. Mr. KETCHUM, the Chief Engineer, expects that the railway will be finished next year.

JAMAICA RAILWAYS, to the extent of 65 miles, have been bought of the Government by an American syndicate for $4,000,000, of which sum $500,000 was paid down to the Government of Jamaica and the rest is to remain in bonds and mortgage. The lines extend from Kingston to Porne, and from Spanishtown to Ewarton. These lines are to be extended to 185 miles in total. Two parties of engineers have been in the field for several months, and though no grading contracts have been let bids have been received for steel rails from England and the United States. The lowest bid for rails came from Birmingham, Ala. By the terms of the contract 12½ miles of the road must be finished each year; included in this construction will be a number of bridges and tunnels. The Government of Jamaica gives the syndicate 65,000 acres of land, and guarantees bonds to the amount of $40,000 per mile.

RAILWAY ACCIDENTS IN ENGLAND caused a heavy increase of deaths and injuries in 1889, owing chiefly to the disastrous accident on the Great Northern Ry. of Ireland, June 12, in which 78 were killed and 200 injured. Deducting these, however, there were only 10 killed in train accidents and 816 injured, against 11 killed and 594 injured in 1888. As a whole, wonderful progress toward greater safety by rail has been made in England in the last ten years. The numbers killed and injured from all causes were 1,076 and 4,836 respectively, against 905 and 3,826 in 1888.

THE ENGLISH OUTPUT OF BESSEMER STEEL RAILS in 1889 was 943,048, as against 979,083 tons in 1888. This is a decrease of 36,035 tons over 1888, and 78,799 tons for the two preceding years. The annual report of the British Iron Trade Association says that there has been a slight increase in the general 1889 export of railroad iron and steel as compared with 1888. After India, the Argentine Republic was the heaviest purchaser, having taken 263,135 tons. The export of 1886 to the Argentine Republic was only 59,392 tons. The United States only took 18,561 tons in 1889, as against 182,232 tons imported in 1887.

THE *Verein Deutscher Eisenbahn Verwaltungen* offers prizes for the best inventions or essays on the following subjects: (*a*) A design of a locomotive boiler which will be safer against explosions than those now in use, cost less to maintain, and be lighter. (*b*) Improvements in the construction of the locomotive, especially the valve gear, leading to a better use of the steam. (*c*) A plan for the simplification of car accounts. (*d*) A good, durable pipe for coupling heating and brake pipes in which rubber is not employed. (*e*) An efficient and cheap continuous brake for freight trains. Money prizes amounting to $7,500 will be given. All designs or papers must be sent to the society rooms, Bahnhofstrasse 3, Berlin, between Jan. 1 and July 15, 1891.

SPECIAL TRAINS were responsible for the four worst accidents of the week, or nearly the worst. They were as follows:

May 9, Livermore, Cal., work train struck by special passenger train in a tunnel; one killed.

May 11, Prescott, Wis., special train for a theatrical company ran into a hand-car, killing three and severely injuring two, and badly crippling the engineer.

May 15, Butte, Mont., special theatrical train derailed; three killed.

May 16, Broadland, Ill., pay train telescoped a local passenger train, killing one and injuring two.

This is a pretty good list for one week, covering as it does only accidents selected as somewhat notably severe. In the last case the usual preposterous claim that "the air brakes refused to work" was advanced.

TWO LOCOMOTIVE BOILER EXPLOSIONS are reported; one on a Louisville & Nashville freight locomotive at Danville, Tenn., and the other on the Atchison, Topeka & Santa Fe, near Wellington, Kan.

BRIDGE ACCIDENTS are reported as follows: On the Upper Coos R. R., in New Hampshire, a wrecking train went through a bridge undermined by a washout. At Danville, Ind., the false works for a new highway bridge were carried off by high water on May 13. At Vancouver, B. C., a large bridge across the north arm of the Fraser river collapsed on May 13. The bridge was being built by the San Francisco Bridge Co., to replace one carried out last year by the pressure of the ice.

A DAM GAVE WAY at Goldsboro, Me., May 16, controlling a lake of 3,000 acres, 15 ft. deep, carrying out several other dams and small bridges, but fortunately doing little further damage. The dam had been suspected for two years.

THE *City of Paris* accident is to be officially investigated by the English Board of Trade. Earl de la WARR also proposed a similar investigation before the House of Lords, and to especially inquire why the steamship was unprovided with a marine engine governor that would have operated under the circumstances stated, and why she was so absolutely without sail power as to have drifted many miles out of her course. These bodies might also investigate the engine details while they are about it.

THE STEAMER "BEACON LIGHT" from Newcastle, England, collided with an iceberg on the night of May 13 when in latitude 43° 55′ and longitude 48° 18′, crushing in a portion of the forecastle head and bending several plates in the starboard bow, besides doing considerable other damage. The steamer was owned by Stuart & Co., of Liverpool, oil dealers, and carries a crew of 28 men. Her dimensions are: length, 332 ft.; breadth, 40 ft., and depth, 28 ft. She was built at the yards of Sir Wm. Armstrong & Co., at Newcastle, registers 2,107 tons, and can make 13 knots per hour. The vessel was new, and this was her first voyage across the Atlantic.

THE "NORMANNIA," the new ship of the Hamburg-American line, has been built in 12 months. She is a twin-screw steamship of 8,500 tons burden, of 16,000 H. P., and showed on her trial trip a speed of 21 knots, though the guarantee was for only 14,000 H. P. and 19 knots per hour. The *Normannia* was built by the Fairfield Ship Building Co., the successors of the famous John Elder & Co.

THE NEW NIAGARA RIVER BRIDGE BILL has been signed by Governor HILL. The bill provides for the construction of a bridge across the Niagara River about 1,000 ft. north of the present railway suspension bridge. The capital stock is $500,000, with the privilege of being increased to $2,000,000, and the company is to be managed by a board of nine directors. The construction of the bridge must be begun before July 1, 1895, and the bridge completed within five years after beginning construction. The company is stated to have been organized in the interest of the Canadian Pacific Ry. Co., and the bridge is being built to furnish it an entrance into Buffalo, N. Y.

A SECOND CAISSON ACCIDENT occurred at the Louisville and Jeffersonville bridge at 5.10 P. M., on, May 14, at Pier 4. At the time of the accident, the working chamber of the caisson had been built launched, and was in position between two rows of heavy guide-piles, tied together at heads, and the crib was being built upon the caisson roof, 13 courses being in position and partly concreted. The river had been rising rapidly, and the current was very strong, and the water about 28 ft. deep. The pressure against the submerged mass was great enough to cause some apprehension, and only about one-half of the usual force of 30 men was at work. At the time stated the guide-piles at the lower end gave way first, and the other side followed; the caisson and crib thus unsupported, toppled over and carried with it the caulkers and carpenters, and four men lost their lives, among them CHARLES P. MITCHELL, the Superintendent for Sooysmith & Co. Mr.

MITCHELL was struck by one of the falling cross-braces, and the other men were carried under the caisson and the floats by the swift current and drowned.

The "six" guide-piles were 18 ins. in diameter, driven 20 ft. into the river-bed through 28 ft. of water, says the *Courier-Journal*, of Louisville. The caisson was 25 × 54 ft. on the base and was 24 ft. high, including the roof. At the time of the accident the top of the caisson proper was 2 ft. under water, but the cutting-edge was not quite on the river-bed. The caisson was suspended at the four corners by steel-wire rope to the cross-bracing supported by the guide-piles. According to the report of LOUIS P. ANSCHUTZ, one of the caulkers, these cables parted and at the same time the supporting timbers gave way. The caisson itself is said to have turned completely bottom-side up.

SUBSIDIARY ELECTRICAL CONDUITS, extending from the main conduit to the curb of the pavement, are just now a live subject of discussion between Commissioner of Works GILROY, of New York, and the Subway Commissioner's Engineer, Mr. KEARNEY. Mr. KEARNEY claims that such connections would be very expensive and that it is absolutely necessary to be able to reach the main cable. Mr. GILROY says that a bill is now in the hands of the Governor of New York which compels the subway company to make these connections, and further provides that the Commissioners of Works can make them at the expense of the company. Mr. GILROY denies that pavement can be relaid so as to be as good as when first put down; and the experience in New York certainly justifies his adverse opinion.

THE DANGER FROM FIRE IN ELECTRIC PLANTS is a disputed quantity, but it seems clear that a carefully designed and conducted establishment has no dangerous elements about it, while one badly designed and managed may be a source of constant danger. Statistics of the causes of fires are interesting in this respect, although the number of electric lights is small in comparison with that of other kinds. The following figures show the causes of the fires that have occurred in London within the last few years:

	1887.	1888.	1889.	Total.
From candles	142	113	136	391
From gas	188	197	209	594
From oil and petroleum	245	205	257	707
From electric light plants	...	1	2	3

THE PHONOGRAPH has been resorted to as a means of preserving the language of the aborigines of North America. It has been successfully used for this purpose by Mr. J. WALTER FEWKES with the Passamaquoddy Indians, and is now being used on the Pueblos of New Mexico. At the Milwaukee College the phonograph is used as an assistant in teaching French and other foreign languages.

THE HUDSON RIVER TUNNEL PROGRESS to date is about as follows: West side; shield in position and connection being made with brickwork; the shield will probably be advanced in actual work next week. East side; the trouble from leaks overcome, and men are busily at work building a bulkhead and enlarging the tunnel for the introduction of the new shield.

A NEW DISPOSAL OF LONDON SEWAGE is proposed by Messrs. R. HASSARD and A. W. N. TYRRELL, of London. The sewage would be delivered at Dungeness Point, which is a flat, desolate promontory jutting out of the Romney Marshes, and where there is 90 ft. of water close to the shore. It would be here constantly discharged many feet below the surface into swift currents. The distance from Crossness is 56 miles. The estimated cost is $28,750,000 for all expenses, and $150,000 per annum for pumping.

A FEAT IN LONG-DISTANCE HELIOGRAPHY was accomplished in Arizona, May 17, by Lieut. WITTENMEYER, who succeeded in signaling a message by a single flash 125 miles from Mount Reno, near Fort McDowell, to Mount Graham, near Fort Grant, where it was received by Capt. MURRAY. The latter, by turning his instrument, flashed the message to Fort Huachuaca, a distance of 90 miles, making a distance of 215 miles with a single intervening station. The longest distance heretofore made with a signal flash is said to be about 70 miles.

Heating Furnaces.*

A SIEMENS furnace will probably call for less repair than any other kind of a reverberatory furnace. The gas and air, coming up separate ports, do not unite until they have reached the hearth, where they come in contact with the metal to be heated. By the time the flame reaches the out-going ports it is pretty well spent, and does very little more injury to the brickwork than the incoming gas and air. The bricks are not subjected to the cutting action of flames as they are in a coal furnace.

The heated regenerators give the gas and air an upward tendency. This makes an outward pressure when the chimney damper is partially closed. It is necessary to work the furnace with an outward pressure when it is charged close up to the door, to fill the furnace with flame and keep the cold air from drawing in at the doors, or when the charge, on the hearth of the furnace, is up to the required heat, and the drawing of it is delayed for a short time.

In the Smith furnace, the regenerators are built in the ends of the furnace. The checkers are entirely open at the top, and on a level with the bridge of the furnace, which is at the same time one wall of the gas chamber. This furnace is generally used for quick heating. Its advantages are: the cheapness, the ease with which the checkers can be taken out and cleaned, and the bottoms of the gas and air conduits and the checker chambers are so little below the surface that they are not likely to become choked by water in low ground. Possibly the gas will not come in the furnace with as much pressure as in an ordinary SIEMENS furnace, unless the gas-pipe from the top of the gas-producer stack is correspondingly higher. Gas is purer when it has a long way to travel from the producer to the furnace, the soot has a chance to deposit on its way, but the expansion and contraction of a long overhead tube must also be considered and provided for. The gas checkers often become clogged with this soot. The best way of cleaning them is through spontaneous combustion, which is brought about by shutting off the gas entirely from the furnace, placing the reversing valves on the center, and opening the stack damper and at the same time a door of the furnace. There will then be a free passage of air from both ends of the hearth down through the checkers. A small amount of reddish matter will be left as a product of the combustion. When a gas, made of vaporized oil and steam, is used as the fuel, it comes into the checkers with such force that it will find its way through a choked mass of checker-work, when coal gas, with its gentle pressure, will not.

The hearth of a furnace is not of equal temperature over all its surface. There are different reasons for this: the design of the bridge, the arch in the roof tending to draw the bulk of the fire through the middle of the furnace, and the cold air at the doors chills off the front. If the piece of metal reaches all the way across the furnace, and the gas and air enter side by side or mix before coming over the bridge, there is very little difficulty in putting an even heat on the piece from end to end.

To do good and careful heating the bottom of the furnace must have plenty of attention, especially when the stuff is charged by a mechanical device. The scraping over the bottom soon tears it away. With good fire-sand and care there is no trouble in maintaining a clean, hard bottom, gradually sloping toward a tap hole at the back of the furnace midway from the end. This, besides being a help to the heating, makes charging and drawing easy. The bottom can be made and maintained with a slope toward one tapping hole easier than to two or even three. A high place on the hearth can be cut down by putting some fine coal on it; the ash of the coal combines with and fluxes the silica of the sand.

The process of "burning down" a high bottom is injurious to the furnace, since it is necessary to raise it to such a high temperature that the bricks in the roof drip.

A sand with too much clay in it is liable to cling to a piece of steel all through the rolls, and show in yellow streaks on the finished bar.

When the cinder sinks into the blow-holes and unevenness of the steel, and then is lengthened into streaks in the working of it, the finished stuff is termed "snaked." These snakes show to the prejudice of the steel when it is highly polished, as for instance in various weapons. A seam is where the metal is actually parted; it is generally called "piping." A low carbon steel stands nearly as much heat as iron. In heating high carbon steel the metal must be very gradually brought up to a heat sufficiently high for working it. To charge cold steel of high carbon into a warm furnace is disastrous to the metal, particularly when the steel is frosty. It is an easy matter to build a wood fire around the steel and warm it throughout to at least 200° or 300° before charging. This will mitigate the strain on the inside when the outside begins to expand with the heat of the furnace.

A very fine steel, not too high in carbon, will scale off in sheets, while the scale from a high carbon steel will break up into fine powder as it comes off. This can be more readily seen under the hammer than at the rolls, where there is generally so much water. Gas which contains steam oxidizes the steel and makes a good deal heavier scale than other gases, ordinarily from 1.25 to 2% on ingots charged hot.

Furnace crowns have been built on a great many different plans, but, after all, the one that gives the most satisfaction is a roof that dips about five degrees at each end for one-quarter the whole distance, and then straight across, with the necessary arch sideways for support (Fig. 1); or even a straight roof, with the necessary arch. A very rough crown obstructs the draught across the furnace; the unevennesses create eddies.

The height of the crown above the hearth depends somewhat on the size of the pieces to be heated, and for cold metal is generally four or five times the thickness of the pieces. When the metal is only reheated it is not necessary to have the roof so high.

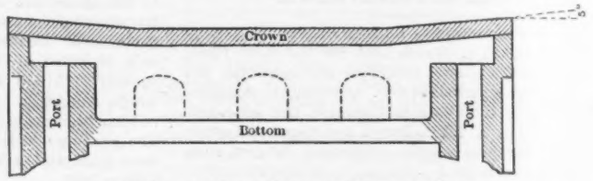


Fig. 1.—A Good Type of Furnace Crown.

By exposing a piece of steel to too high a temperature in the furnace, a crystalline structure is induced which renders the metal unfit for further hammering or rolling. The evil effect of this overheating is, partially at least, remedied by lowering the temperature to a point below that at which it is generally worked and gradually bringing it up again to the right degree. This is attained by various devices, the most common of which is to pass a highly reducing flame over the hearth. When the steel is overheated or burnt to a greater degree, the burnt part is covered with a flat piece of wood, or some sand, a short time before drawing; and sometimes coke or charcoal dust is spread over the bottom of the furnace, and the overheated parts turned into it. Besides bringing about a lower temperature, all these methods shield the metal from oxidation. It is possible to restore steel and iron almost to what they were before being overheated by working the piece a great deal. At its best, however, the metal is treacherous, and on any account it should not be used where much depends on its strength.

The top and sharp corners on the top side of a piece of steel are the only parts liable to become overheated. The bottom of the furnace being in contact with the underside of the piece keeps it lower in temperature than the sides and top, so much so that it is necessary to turn the piece, that the underside may be on top for a short time before drawing, in order that it may have an even heat. For these reasons pieces of steel, at the stages in their working where they have to be re-heated, should be left in such a shape as to favor these things. The round corners on ingots, and the fillets in the grooves of blooming rolls, are in favor of both

* A paper by D. K. NICHOLSON, Steelton, Pa., read at the Cincinnati meeting of the American Society of Mechanical Engineers.

the heating and turning. A very large slab cannot be turned on the hearth in any convenient manner. In this case one end is propped up with a fire-brick, to give the flames a chance to sweep under it.

In a coal furnace for heating iron or mild steel the hearth has a gradual slope from the bridge to the velvetry, which is the hottest part of the furnace, and is tapped at the base of the chimney, giving advantage of all the bottom. For working steel the bottom is sloped toward a tapping-hole at the back, near the velvetry. The furnace is not worked hot enough to be tapped at the flue.

Various plans are put into practice to aid in burning the smoke and gases driven off a green fire. These are, however, generally abandoned after a while, and the furnace is worked with simply a fire-box and forced draught, or a combination of natural and forced draught. In introducing these schemes for burning the gases, very often the advantages from them are over-estimated, and the grate surface is made too small. Coal furnaces are now built when it is not considered worth while to go to the expense of building gas producers. They are convenient at a hammer where a high heat is wanted for a short time; but, generally speaking, they have had their day. A coal furnace will not compare with a gas furnace, where an almost even temperature is held from week to week, especially when it is only required to bring metal which is already warm up to a hammering or rolling heat.

Explosions are prevented, in starting up a gas furnace, by building a fire on the hearth to heat the regenerators and surely ignite the gas as soon as it flows out of the port and mixes with the air. The principal virtue of the heated regenerators is the creating of a draught. The chambers are filled with the gases from the combustion of the fuel on the hearth and air if an excess has been passing over, so that, when the gas is let on, the heated chamber causes it to ascend so rapidly that there is very little danger of its forming an explosive mixture with whatever air there may have been in the chamber. By introducing little trap doors at each end of the gas valve box, cold air may be admitted, with the outgoing current, to cool the gas valve. This checks the draught through the gas checkers to a certain extent, and sends an extra amount through the air. These arrangements are used in melting furnaces, and will hardly be found necessary in heating furnaces. Natural gas is not passed through regenerators, but introduced at the end of the furnace. There is no danger in turning it on when there is a fire on the hearth.

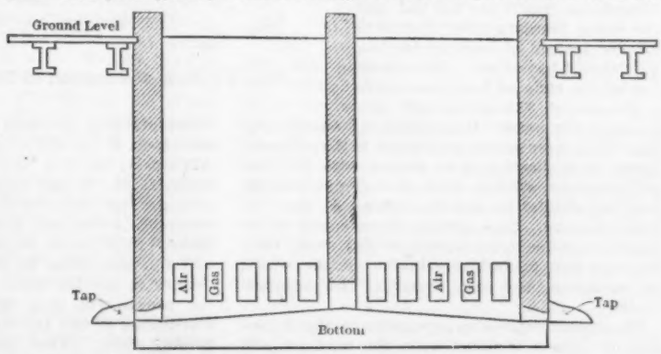


Fig. 2.—A Good Design for a Pit Furnace.

Vertical or pit furnaces are only used to reheat ingots brought to them soon after being cast. These furnaces save labor in charging and drawing, but they are not equal to horizontal furnaces for heating an ingot evenly. The greatest stumbling-block to be contended with in their working is the getting rid of the cinder, especially when low carbon steel is being heated. This is attempted in two ways: one in tapping through the bottom at the center of each compartment, and the other in sloping the bottom of all the compartments toward one end, where there is a tap-hole, the same as in an ordinary furnace. It is a difficult matter to keep this gradual slant on account of the tendency of the bottom to pile up under the partitions that divide the furnace into compartments. Tapping through the bottom is the safest and best way of these two, if the tap-hole could be easily opened and closed. This draining off of the cinder is a most serious matter, as it so easily cuts its way down under the ports to the crown of the nearest regenerator chamber. Altogether the best design seems to be a pit with only one partition and a tap-hole at each end of the hearth (Fig. 2), with the regenerator chambers removed a safe distance from the bottom of the furnace. Although the ports are generally only a few inches above the bottom, and a sharp flame is liable to burn the butt-end of the ingot, there is no advantage in raising the ports. In fact, they do not heat so well when the ports are raised much above the bottom. These furnaces require, from different causes, a good deal of repair. Considering this and the disadvantage of having everything underground, it is a question whether they are more economical than horizontal furnaces. It might be added that it is possible to heat cold ingots in these pits, but it is not at all profitable.

Soaking pits, of course, require no fuel, and the ingot is handled with more speed and ease than even in the pit furnaces, on account of only one ingot being put in a pit. In a soaking pit the ingot must be charged very soon after it is cast, so that there will be heat over and above what is necessary to give a uniform heat to the ingot, to furnish heat for that which is lost from the sides of the pit. It is possible to charge the ingots too soon after being cast; for instance, where they can be swung around and put in the soaking pits by the same crane that lifts them from the casting pit. When the Bessemer is running very fast, there would hardly be room enough to let the molds and ingots stand in the pit until the time that the ingots would be fit to charge. This can be avoided by casting in molds mounted on a truck, and then taking the whole affair away from the Bessemer to the soaking pits, within a reasonable distance (50 to 75 yards). From the nature of the case the ingot is not likely to roll so well from a soaking pit as when it is heated in a furnace with fuel supplied to it. The inside is bound to be softer than the outside and more yielding, and this throws more strain on the outside, while being hammered or rolled, than is its share. The strain on the outside is not backed up by resistance on the inside, and so a weak place will give way to the strain and crack. When heated in a furnace the outside of the ingot is more likely to be as hot as the inside, or even hotter, since the heat comes from the outside as well as the inside. In ordinary running at least 90% of the ingots from the Bessemer could be cared for by soaking pits. This is a considerable saving of fuel, labor, first cost, and practically no repairs.

The Swinerton Polygonal Driving Wheel for Locomotives.

In 1887 a patent was granted to CHARLES E. SWINERTON, of New York, for a locomotive driving wheel of polygonal form. In 1887 a locomotive named the "Onward," was built to the order of the Swinerton Locomotive Driving Wheel Co. by the Hinkley Locomotive Works, of Boston, under the supervision of Mr. KOLSETH, then Master Mechanic of the Boston & Lowell R. R. During 1888 and 1889 this engine was tried in regular service on the Boston & Lowell and Boston & Maine roads. Previous to the construction of this engine, polygonal wheels had been fitted to the engines "Salem" and "Messenger," of the Boston & Lowell. The tires are milled in a machine especially designed for the purpose.

We have described this wheel and the work it has thus far performed at considerable length, for the reason that it is one of the few devices intended to revolutionize railway matters which have been given any practical trial, and it is interesting as a matter of record, but we have no confidence in the polygonal wheel or in the advantages claimed to be derived from its use.

The claim made for this form of wheel is that increased traction is obtained, due to the extent of bearing area of the wheel upon the rail. A pamphlet issued by the company explains the idea as follows:

This wheel is formed by cutting a large number of flat surfaces or facets around its periphery or tread, which are connected with each other by very obtuse angles, so that when the wheel passes over the rail, an inch or more, according to the width of the facet, is successively presented in actual contact with the rail, thus obtaining far greater traction than is possible with the cylindrical wheel, which depends for its traction upon merely a mathematical line, a point of contact so slight that scientific works state that if the contact of a locomotive driving wheel was any less than at present locomotion by railway trains would be impossible.

The latter part of the above paragraph is certainly incorrect, since the actual contact between driving wheels and rails is not a mathematical line, but (as has been proved by careful tests) a surface of oval form, averaging perhaps ¼ × ¾ in. This is owing to the compressibility of the metal of the wheel and rail.

In regard to the question of slipping of driving wheels, the pamphlet has the following:

It is well known to every person, at all familiar with railroad locomotion, that, under certain conditions, the driving wheels of a locomotive slip and fly around upon the rail, under which circumstances they are powerless to move the train behind them; but it is not generally understood that after the train is in motion the driving wheels may and frequently do slip, even while the train is running at a high rate of speed, yet this is strictly true. It is also true that driving wheels slip in going down grade as well as in going up grade, though not to the same extent. The slipping of wheels while trains are in motion is what is termed imperceptible slipping, for it is not very apparent to the eye while the wheels are revolving, yet if they are watched closely it will be seen that the revolutions are out of proportion to the speed of the train.

Experiments made in France, a few years ago, demonstrated that the imperceptible slipping upon a certain railway there amounted, on the average, to 22 per cent.; in other words, when a train had run 100 miles the driving wheels had made sufficient revolutions to carry it 122 miles. Plainly the power required to make the revolutions for the extra 22 miles was utterly lost to the railroad company. Doubtless, upon the hilly, winding railroads of New England, the average loss through slipping wheels is equal to 30 or 33 per cent., and there is sound reason to believe it is even more than this. Mr. John Thompson, while Superintendent of Motive Power on the Eastern R. R., states that he made experiments upon a freight train running between East Boston and Portsmouth, by putting a device upon the driving wheels to count their revolutions, the result of which he found to be that week in and week out the driving wheels ran 76 miles to haul the train 51 miles; it should be stated, however, that a small part of the discrepancy was due to shifting at stations.

This last alleged test, by whomsoever made, is certainly inaccurate, and in all probability a large part of the discrepancy was due to the shifting at stations. In regard to the above mentioned experiments made in France, Mr. A. M. WELLINGTON, in his "Economical Theory of the Location of Railways" (p. 45), says:

On the other hand, tests of various American passenger locomotives at speeds at from 75 miles per hour down, made by Prof. Chas. A. Smith, Mr. Albert F. Hill and Messrs. Henry Abbey and Oscar H. Baldwin (see *Engineering*, August, 1885), to mention no others, have uniformly indicated that no such phenomena occur with American locomotives under any circumstances.

It is practically certain that they do not occur with any kind of locomotive whatever, at ordinary speeds of under 40 miles per hour.

In regard to the further objections to his system the inventor says:

It has been the fate of all inventions to meet with opposition, and usually it has come from sources where it was least expected, and often from those persons who subsequently received the greatest benefit from them.

It has been objected: 1st, that the wheel would pound or operate so roughly upon the track as to injure the machinery; 2d, that the obtuse angles would soon wear out, perhaps in 100 miles run or less, and the wheel become cylindrical; 3d, that no increase of traction would be obtained since it was held that increased traction depended solely upon increased weight.

To the first of these propositions answer is made that experiments have been made on driving wheels having facets varying from ⅜ in. to 2 ins. in width, and although the engines have been run at the highest rate of speed of which they were capable, yet no increased jar or pounding could be detected; the spring of the road-bed and the springs under the engine took up the jar and distributed it.

To the second, that an engine has been run on the Boston & Lowell R. R. more than 60,000 miles and although the tires had worn down nearly ¼ in. yet under a steel rule the facets were plainly perceptible. Flat places

that occur on driving wheels from skidding them cannot be taken out by the ordinary wear, then how can those on the polygonal wheels be removed by the same treatment?

The third, it is claimed, may be disproved by many familiar illustrations, showing that traction does not depend solely upon weight, but partially upon conditions; a few drops of oil under the drivers renders them powerless to draw the train. An engine having behind it one car more than it can draw will revolve its wheels, and this revolution in a few minutes will cut concave surfaces in the rails, in which the convex surfaces of the wheels will be fitted. Now if the engine be stopped a few seconds and then steam be given it gradually, it will be found that the engine will draw the train; the weight is the same in either case, but the conditions are changed and the result is changed.

It will be easily understood that the facets being only 1 in. long, are almost imperceptible on a 66-in. wheel. The middle ordinate of a chord of 1 in. with an arc of 33 ins. radius is only 1-266th part of an inch, while for an arc of 21-in. radius it is only 1-416th part of an inch. In regard to the noise it is admitted that considerable noise was caused by a set of these tires on a locomotive of the Manhattan Elevated Ry., New York; these tires (for 42-in. wheels) had facets 1 in. long, the same as on tires for 66-in. wheels. It is claimed, however, that by lessening the length of the facets in proportion to the difference of diameter of the wheels, that no such noise would be caused.

Mr. SWINERTON has a number of letters from engine drivers, of the Boston & Maine R. R., who have run engines equipped with the polygonal wheels, and these drivers consider that polygonal wheels enable the engines to do better work than the ordinary wheels. The engines mentioned are the "Salem," Boston & Lowell R. R. (which was the first engine fitted with these wheels); the freight engine "Beach Bluff," Boston & Maine R. R.; and the "Onward," with single pair of driving wheels, which was built to Mr. SWINERTON'S order. The latter engine was given an extended trial in regular service on the Boston & Maine R. R., and in regard to this trial Mr. WM. SMITH, Superintendent of Motive Power and Machinery, has expressed himself as follows:

"The locomotive 'Onward' commenced her regular trip on our Portland express Jan. 7, 1889, and was taken off July 6, 1889, after running just six months. Her performance on this train gave good satisfaction and she made her time. The train is a four-hour train, distance 115 miles, with 15 stops; number of cars from 6 to 8."

Engine No 19 of the Manhattan Elevated was fitted with polygonal tires, but the facets on these 42-in. wheels were made the same length (1 in.) as those on the 66-in. wheels of the "Onward." The result was a considerable noise, but it was claimed that this would be avoided by making the facets only $\frac{1}{4}$ in. long. We are informed on authority that the wheels have not proved a sucess on this engine.

The following is a general description of the "Onward." This engine has a single pair of 66-in. driving wheels, a four-wheel leading truck with 33-in. wheels, and a single pair of 42-in. trailing wheels which adjust themselves to curves in the track. Cylinders, 18 x 24 ins. Richardson's balanced slide valves. The boiler has 220 tubes 1¾ ins. diameter; grate, 90 x 42 ins.; extension smoke box and straight stack. Boiler pressure, 150 lbs The engine has the vacuum and Westinghouse air brakes, and is fitted for heating trains by steam. The tender has a scoop for taking water from track tanks. The driver brake shoes bear on the side of the wheel and do not touch the polygonal part of the tire. Weight of engine, 45 tons, with 32,000 lbs. on the driving wheels. An additional weight of 4,000 lbs. can be put on the driving wheels by admitting air into a cylinder at the end of a lever attached to one of the driving spring hangers. Compressed air is also used to ring the bell and to apply sand to the track when necessary.

In July, 1889, comparative tests of the power of this engine fitted with polygonal and with smooth driving wheels were made at Lawrence, Mass., on the Boston & Maine R. R., up a grade of 38.70 ft. per mile: "with air" means with air used to apply the extra weight in the driving wheels; "without air" means without this extra weight. The table gives the maximum loads hauled, starting from rest and taken up the grade. Mr. SMITH, of the Boston & Maine, Mr. KITSON, of the C., R. I. & P., and other railway men, were present.

July 16, 1889. With polygonal driving wheels.

	8-wheel gondolas	4 wheel coal-cars	Weight of cars and load.	Weight of cars, engine and tender.
Without air and without sand	10	10	859,550	1,002,700
With air and without sand	10	16	967,600	1,110,570
Without air and with sand	10	35	1,328,346	1,471,496
With air and with sand	13	41	1,602,046	1,745,196

July 23, 1889. With smooth driving wheels.

Without air and without sand	5	0	320,500	463,650
With air and without sand	9	0	545,570	688,720
Without air and with sand	11	11	830,870	974,020
With air and with sand	13	20	1,078,960	1,222,110

This engine has been tried on the Central R. R. of New Jersey. In February last, running with a light passenger train between Roselle and New York, she did very well, but had to use sand in starting from stations. The engine was then put to hauling a train of four cars between Jersey City and Easton. With a dry rail she made the time, using sand until the train was up to speed. On Feb. 8 the rail was bad; sand had to be used, but the driving wheels slipped very badly, and the engine lost 18 minutes in the running time. At no time on this run was the pressure of steam below 140 lbs. At one time the engine was put to haul a fast passenger train from Jersey City to Bound Brook; the bituminous coal in use was bad, and the steam pressure varied from 90 to 110 lbs., instead of being at 140 lbs., as it should have been. The engine hauled the train of four heavy cars a distance of 30.2 miles, with two stops, in 43 minutes. It is considered on that road that while there may be some merit in the polygonal wheel, its application on an engine with only one pair of drivers will not enable that engine to do the work required of it, and the "Onward" does not make the time. This is claimed on behalf of the engine to be due to the quality of coal used. Only two runs were made during April. On the whole, no advantage has been found in the polygonal wheel.

The general impression appears to be that a good deal of reliance is placed upon the sand jet, and upon the device for increasing the weight on the driving wheels. While the table above given is on pretty good authority, and shows some very surprising results, we are by no means prepared to accept the figures as in any way conclusive. Tests of this kind are of little real value unless carried out extensively, and all the varying conditions noted and taken into account. We have already shown that the claim for increased area of contact between wheel and rail is incorrect, and it is not probable that the "polygonal" wheel will be used except in a limited way for experimental purposes. It certainly does not seem to be designed on a correct mechanical principle.

The Niagara River Power Co.

Owing to the absence of the editor in charge of the matter, the article on the Niagara River Power Co. was given in our last issue without the cuts that should have accompanied it, and also without some corrections made necessary by several material changes in the original location and plan of operation of the late Mr. THOMAS EVERSHED, C. E. These changes, of course, cancel the estimate of cost given in Mr. EVERSHED'S original report.

The engineer of the present work is Mr. ALBERT H. PORTER, with Mr. COLEMAN SELLERS, and Mr. CLEMENS HERSCHEL as consulting engineers. These gentlemen have made a radical change in the location and extent of the canal and tunnel. Instead of being placed considerably inland and running parallel to the Niagara River to a point about 2½ miles above the Falls, as proposed by Mr. EVERSHED, the canal will takes its water from the river nearer Port Day, about 1½ miles above the Falls, as shown in Fig. 1.

A general typical arrangement of the feeding canal, wheel-pits and tunnel for the discharge of the tail-water, is shown in Fig. 2. This brings the tunnel directly under the canal, instead of placing it under a series of short canals, communicating with the river at right angles to the tunnel, as originally contemplated.

The general profile of the tunnel is shown in Fig. 3; but the gradients, volume, etc., under the new plan, have not yet been made public by the engineers. As a consequence the data given in the estimate of Mr. EVERSHED, and particularly his estimate of cost, will be very materially modified by the publication of the later data as soon as these can be obtained.

As a water power, Niagara River has a storage reservoir of 87,020 sq. miles of lakes, and 241,235 sq. miles of water-shed. The Government weather bureau reports an average annual rainfall for this whole area of 37 ins., and it is probable that 30 ins. is the minimum. Assuming this 30 ins., and taking

Fig. 1.—Plan of Location of Tunnel and Canal.

12 ins. of this as the mean flow out of the river, we have 53 cu. ft. per minute per sq. mile of water-shed. At this rate the flow over Niagara Falls would be 12,785,455 cu. ft. per minute, or 213,000 cu. ft. per second. The measurements made by the Lake Survey indicate that the average flow of the Niagara River is 265,000 cu. ft. per second.

The present plans of the Cataract Construction Co. are to develop about 120,000 horse power, and the canals will then draw from the river only four-tenths of one per cent. of the volume of the passing water. When this point is taken into consideration the absurdity of the charge that the wastes of the mills will pollute the water passing over the Falls, is very apparent.

According to a corrected table of levels the water of Lake Ontario is 246 ft., and the surface of Lake

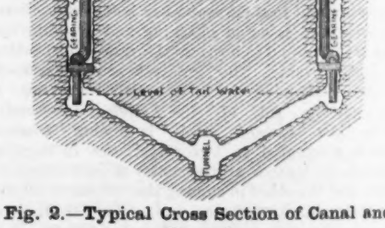


Fig. 2.—Typical Cross Section of Canal and Tunnel.

Erie, 578 ft. above mean tide at New York City; or, there is a difference in level between the two lakes of 326 ft. The geological strata at the Falls is made up of about 17 ft. of earth, commencing at the surface, 122 ft. of limestone, 17 ft. of grey limestone, 63 ft. of shale and then sandstone to a point below the tunnel line; these strata are generally horizontal. The tunnel will be located at an average distance of 160 ft. below the surface.

Some very interesting engineering problems will arise with the carrying out of this enterprise. One which will interest hydraulic engineers will be the utilization of this great volume of water under pressures as high as 100 lbs. per square inch. Wheels to

utilize this great head and enormous volume combined have yet to be designed.

Another interesting problem on which some prominent electricians are at work is the feasibility of transmitting some part of this enormous power electrically to Buffalo and other cities in the vicinity. The vast power which can be developed here and whose sale is certain, provided its transmission is practicable, make this one of the most important features of the problem.

The surveys for the tunnels and canals are nearly finished, and contracts for their construction, we are informed, are soon to be let. Further information may be secured by addressing the Cataract Construction Co., Mills Building, New York City.

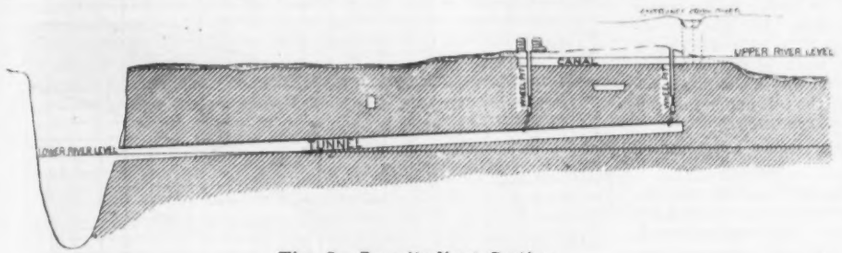


Fig. 3.—Longitudinal Section.

The Cincinnati Meeting of the American Society of Mechanical Engineers.

"We are the people!" exclaimed a jolly young man as he entered a Pullman car at the Jersey City station of the Pennsylvania Railroad, set down his grip and shook hands with an acquaintance. The car was one of the cars of the special train which was to carry the Eastern members of the American Society of Mechanical Engineers to the Cincinnati meeting; leaving New York at 2 P. M. on Monday, May 13. And the young man's statement seemed to voice the sentiment of the party. Whether the rest of the quotation was true, and "Wisdom would have died with us" in case the Pennsylvania Railroad had taken a notion to roll our train down the side of the mountain just west of the Horseshoe curve while on our journey, this record does not attempt to state. Certainly no one of the engineers doubted that, as far as mechanical engineering, at least, was concerned, the party was supplied with as much wisdom, both theoretical and practical, as it or anyone else could possibly have any use for.

The train consisted of three Pullman coaches and a dining car, and was drawn over the first stage of the journey by a locomotive with 78 in. drivers, thoroughly capable of making a very rapid run with the train. Unfortunately, however, on the Pennsylvania Railroad one train is not permitted to try to run by another one on the same track. Our train was the second section of the New York and Cincinnati express, and as the first section persisted in dragging along at 42 miles an hour or so, the expectations of breaking the record were disappointed.

At Philadelphia we were joined by a considerable delegation that made the train just full enough for combined comfort and sociability, and it was a very happy party which sped along westward. The day was all that could be desired. The scenery through the hills and valleys between Philadelphia and the mountains was at its finest. The excellent meal served in the dining car put everyone in even better humor than they were before ,if that were possible.

The only cloud to the day's pleasure was the much regretted absence of the genial Secretary, Mr. F. R. HUTTON, who had unexpectedly been prevented from joining the party by the serious illness of his wife.

Night came on soon after we crossed the Susquehanna and in the pleasant brightness of the car everyone smoked, talked, laughed, discussed questions and told stories, mechanical and unmechanical, which, if they had only been collected by phonograph and published in the "Transactions," would have made that volume as famous as Munchausen's travels. Meanwhile in the rear car the ladies gathered and chattered sociably, while some industriously plied their fingers at the same time on some fleecy fabric or other called, by courtesy, work.

By and by, SNOWBALL, the darky porter, began to arrange the berths, and one after another disappeared behind the curtains. Even in their berths however, a few of the party were on the watch for sights by the way, and a freight wreck near Altoona, the coke furnaces and natural gas wells along the line, and the steel and iron works at Braddock and Pittsburg, were all seen between naps by some of the more wakeful of the travelers.

The pleasant weather which greeted us next morning soon changed to a dismal rain; but neither this nor the news that Cincinnati was threatened with a water famine could quench the good spirits of the party. The interest of our breakfast was heightened by an artistic menu card prepared for our benefit, on which a conventional darky cook stirred hypothetical soup in a classical caldron, making a cloud of smoke rivalling that from a Cincinnati chimney.

At many points along the line our numbers had been swelled till the party reached Cincinnati 75 strong. At the station a delegation from the local committee was waiting to welcome and act as escort to the hotels. A number of members had already arrived from other directions, and the afternoon was spent in making and renewing acquaintances, securing rooms at the hotels, etc.

TUESDAY EVENING SESSION.

At 8 P. M. the members assembled in the Scottish Rite Cathedral, an elegant little auditorium near the hotels. Addresses of welcome were delivered by Messrs. M. E. INGALLS, President of the Cleveland, Cincinnati, Chicago & St. Louis Railroad, and Prof. EDDY, of the University of Cincinnati. Mr. INGALLS alluded to the business interests of Cincinnati and the advantages it offered to manufactures in the way of climate, proximity to markets and to sources of supply, transportation facilities, etc. Prof. EDDY welcomed the members on behalf of the city's educational interests and expressed the belief that the work which this and other engineering societies were accomplishing would yet place American engineering works ahead of those of any other nation.

President OBERLIN SMITH responded to the addresses of welcome, saying that in meeting at Cincinnati the society knew it was coming to one of the Meccas of American engineering, where some of the best machine tools and the best wood-working machinery in the country is built. One of the greatest engineering enterprises of the country, ante-dating even the "Big Four," and Cincinnati, Hamilton & Dayton Railroads was "the Underground Railway" of the days anterior to 1860, the headquarters of which were in Cincinnati. Besides engineering works Cincinnati had won especial eminence in the fields of music, art, architecture, landscape gardening, literature and diplomacy. On the engineers' foreign tour last year a delegation called on the Empress AUGUSTA. In conversing with her the American with whose name she seemed most familiar was the late Minister PENDLETON, of Ohio.

The technical work of the convention was then taken up. The first paper, by Prof. JAS. E. DENTON, "On the Measurement of the Durability of Lubricants," described a considerable number of experiments made by the author in the attempt to find some method of accurately testing the amount of wear which can be obtained from a given lubricant. The conclusion the author came to was that the durability of a lubricant could not be measured except by copying very perfectly the especial conditions under which the lubricant was to be used. Even then, the fact that in many kinds of service dust and grit soon mixes with the oil and necessitates its renewal long before it is worn out, renders laboratory experiments, even if they could be made, of little practical account. In the discussion several gave instances from practical experience which seemed to prove that where pure oil was confined and protected from dust its durability was very great. To a certain extent it was shown that the oil was improved by use. The practical bearing of this point in favoring the use of the bath method of lubrication wherever possible, is very evident.

The next paper, by Mr. C. S. DUTTON, on "Some Experiences With Crane Chains," (republished in the last issue of ENGINEERING NEWS) was read by its author.

The third paper, by Mr. GEO. H. BARRUS, "Memoranda Regarding the Indicating of the Engine of the Steamer *City of Richmond*," was of special interest to the engineers who crossed the Atlantic last summer on that vessel. This was indeed the chief reason for its presentation, the engines being neither new, novel nor good examples of present practice. The test was a good illustration, however, of recent advance in marine engineering. The *City of Richmond's* compound engine of 3,230 H. P. used 2.6 lbs. of coal per I. H. P. hour. The latest triple expansion engines have shown a coal consumption as low as 1¼ lbs. per I. H. P. hour, or but one-half that noted above.

Adjournment was then taken, and the members assembled in the parlors adjoining the auditorium where a light collation was served, and a half hour was spent in social intercourse.

WEDNESDAY MORNING SESSION.

The first business taken up was the report of the governing council, which showed the total present membership of the society to be 1,133. The loss by death during the past half year has been: Messrs. F. B. RICE, HECTOR C. HAVEMEYER, C. A. ASHBURNER, CHAS. D. SMITH, HORATIO ALLEN (Hon. Member), G. A. HIRN (Hon. Member). The present membership is distributed as follows:

Honorary members	16
Life members	9
Members	955
Associates	48
Juniors	104
	1,133

The increase by the ballot for new members was reported by the teller of election as follows: one honorary member (Mr. CHAS. T. PORTER), 85 members, 7 promoted from juniors to full member ship, 3 associate members, and 13 juniors.

The Council has made arrangements by which the society has entered on the occupancy of the house at 12 West Thirty-first St., New York. The house cost $60,000, of which $27,000 has been loaned to the trustees by subscription to bonds issued by that body bearing interest at 5%. The generous response of the membership to the appeal for the cash necessary to close the purchase of the house was most gratifying. Over $10,000 was subscribed beyond the amount necessary to be paid in cash to secure the transfer of the property. A "sinking fund" has been created by which these bonds will be bought in as they fall due, and will become the property of the society instead of individual members.

The report was then read of the committee, Messrs. CHAS. E. EMERY, J. F. HOLLOWAY, and GEO. H. ROBINSON, appointed to address Congress on the matter of erecting a suitable memorial to the late JOHN ERICSSON, Member of the Society. The memorial gave a brief account of ERICSSON's services to mechanical science, but was principally devoted to a recital of the services rendered by him to the Government at the time of its greatest peril. The memorial declared that the did more than any other one man did or could do to save the country. Yet, while learned societies, here and abroad, and many foreign governments vied with each other in lavishing honors upon ERICSSON for his scientific and professional achievements, this nation, to whom he rendered such great service, not only never recognized his loyal devotion, but pursued a most niggardly and dishonorable policy in its payment of the moneys actually due him. The memorial asked that such reparation as is now possible be made by the appropriation of a sum of money sufficient to erect some suitable memorial to the famous engineer.

The report of the committee on a Standard Method of Conducting Duty Trials of Pumping Engines was presented, and as no discussion was offered it was voted to accept the report. At the session on Friday morning a delayed discussion by Mr. A. M. WELLINGTON was presented. The vote of acceptance was then reconsidered, and the motion was carried that the report should lie over for discussion at the November meeting and the committee be

continued. Mr. BARRUS, for the committee, requested that the report should be carefully read and that all interested should send criticisms and suggestions to the committee before the November meeting. (The republication of the report begun last week will be continued in our next issue.)

The report of the Committee on Standard Tests and Methods of Testing Materials was then presented, and, in accordance with the committee's request, it was continued. The report was presented in this provisional way in order to draw out written discussion from members. The committee has not yet been able to make any progress toward standards for ordinary shop testing, but it is hoped by the collection of a great amount of data to be able to formulate standards for these as well as for scientific testing.

The committee on standard flanges for pump barrels and pipes reported some progress and asked to be continued. It was so voted. Out of the 40 manufacturers to whom the committee sent circulars of inquiry, but 11 replied, and only a part of these showed much interest in the matter.

A letter was read from the members of the society residing in Richmond, Va., proffering the hospitalities of the city to the society in case the next meeting is held there.

On motion of WM. FORSYTHE, it was voted that the chair appoint a committee of seven "to formulate a standard method of testing the efficiency of locomotive engines, including the efficiencies of the engine, the boiler, the quality of the steam, and the comparative efficiency of simple and compound locomotives." The committee appointed was as follows: CHAS. B. RICHARDS, Chairman; WM. FORSYTHE, F. W. DEAN, H. B. STONE, JAS. E. DENTON, AXEL VOGT and ALLAN STIRLING.

READING AND DISCUSSION OF PAPERS.

The paper by W. F. DIXON, on "The Efficiency of Locomotives" was presented by the secretary. An abstract of the paper and discussion will be given in an early number of ENGINEERING NEWS. The chief points of the paper were its condemnation of very small clearance spaces, and its "damning with faint praise" the compounding of locomotives. The paper was fully discussed and received some commendation and a good deal of sharp criticism.

The next paper, to the surprise of every one, including, probably, its author, proved to be the sensation of the meeting. It was by W. E. HALL, Asst. Master Mechanic of the Pennsylvania shops at Altoona, on the "Working of Railroads by Electricity." The author discussed, in a general way, the prospect that in the near future electricity would replace the steam locomotive on railway lines, and affirmed that the economy which would be effected by the use of the electric motor would lead to its use in place of the locomotive. The first written discussion was by President SMITH, and was chiefly to show that the way to use electricity on ordinary railways would be to apply a motor to each axle or each car, thus doing away with the enormous weight and resistance of the present locotive. Mr. FRED. A. SCHEFFLER, Superintendent of the Westinghouse Electric Company's works then presented a written discussion in which he showed that to equip and operate an ordinary steam railroad to use electricity would be so enormously expensive that it could not possibly compete with the steam locomotive. Then ensued a most spirited debate. A half dozen or more mechanical engineers rose up to defend "electric power" against Mr. SCHEFFLER'S attack, and criticised his estimates and statements and the work of electrical engineers in general in an astonishing manner. It looked like a friendly battle between the electrical engineers and the mechanical, in which the latter were fighting for instead of against electricity. In an early issue we will reprint the papers that our readers may judge for themselves which side presented the strongest case.

Fortunately for the society, this fiery debate was followed by a paper on "Determination of the Sensitiveness of Automatic Sprinklers."

In this paper the author showed that the common tests of automatic sprinklers, whose results are widely advertised, are likely to be far from correct unless great care is taken in the testing. The mercury thermometer is a sluggish instrument, and to give accurate results it should be corrected for the time of exposure. In the accompanying diagram, taken from the paper, Fig. 1 shows the relation between the actual and the indicated temperature of a thermometer. Fig. 2 is a graphical representation of the amount to be added to the increased temperature for every practical rate of increase of rise in order to obtain the actual temperature.

Written discussions of this paper were presented by Messers. CHAS. E. EMERY, D. S. JACOBUS, C. J. H. WOODBURY and R. H. THURSTON. Several alluded to the fact that sensitiveness was only one element necessary in a good sprinkler. It was advised that the sprinkler be tested under water pressure. Mr. NAGLE'S objection to this was that if the inside of the oven were wet it was impossible to repeat the test under just the same conditions.

WEDNESDAY AFTERNOON SESSION.

On account of the rain the carriage drive arranged for Wednesday was postponed to Friday afternoon, and the papers set for that session were taken up. The first three were by Prof. R. C. CARPENTER, of the Michigan State Agricultural College. Of the first, "Tests of Several Types of Engines under Conditions Found in Actual Practice," a brief extract will be given in an early number. The second paper, "Comparative Test of a Hot Water and a Steam Heating Plant," referred to a test of two heating plants used in greenhouses of rather small capacity. The result was that the hot water heater showed about 25% better efficiency. The third paper, "Notes on Kerosene in Steam Boilers," described the excellent results from treating a very badly scaled boiler with kerosene. It is reprinted elsewhere in this issue.

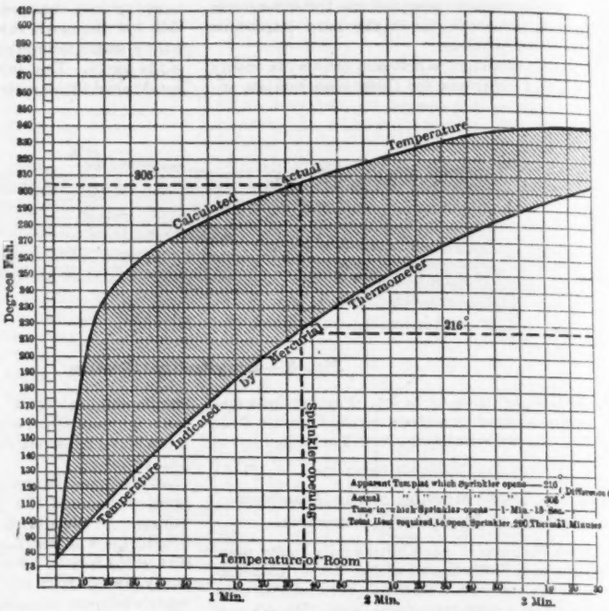


Fig. 1. Relation between Actual and Indicated Temperature of a Testing Oven.

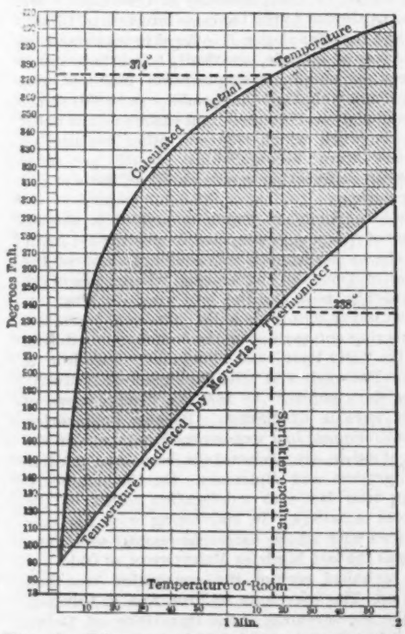


Fig. 2. Diagram showing Method of Obtaining Actual Temperature.

The following three papers were on Shaft Governors for Steam Engines, and some abstract of the three, with discussion, will be given in an early issue. The two following papers were brief descriptions of laboratory instruments of some importance: "An Open End Mercury Column for High Pressures," by W. W. BIRD and "An Automatic Absorption Dynamometer," by G. I. ALDEN. We hope to find space to reprint them.

Questions for topical discussion were then taken up. Question 79 was, "Does a boiler steam more freely if the tubes are so arranged as to be further apart horizontally in the upper rows than in the lower rows?" Mr. J. M. SWEENEY said yes; but stated that he had made no careful tests. Mr. J. W. COLE proposed making the lower tubes of greater diameter than the upper tubes, in order to avoid deflecting the rising current of steam from a vertical. Mr. H. H. SUPLEE said that boilers had been made with larger tubes in the lower rows to secure a more even draft through the tubes.

In answer to question 81: "What is the greatest number of times per minute that a dash pot apparatus can be lifted, such as is used in the Corliss valve gear?" Mr. EDGAR PENNEY described a Corliss engine with vacuum pots in a Trenton wire mill running at 240 revolutions per minute.

Question 82 was: "What advantages as to construction and operation are offered by vertical bending rolls over horizontal rolls for plate?" Mr. SEE described a case where an overhead crane had been used to haul plates through horizontal rolls for bending, thus saving the expense of applying power to the rolls. President SMITH described the vertical rolls for ship plates at Laird's, which seemed to do excellent work and save considerable floor space.

As to question 85, with reference to the purification of bad feed water, the little discussion presented seemed to indicate that a feed-water heater of ample size, which could be easily cleaned, was the best apparatus to use with bad feed water.

WEDNESDAY EVENING SESSION.

The long morning and afternoon sessions of Wednesday had pretty well tired out the members, and it was a thin and not especially enthusiastic audience which was assembled in the evening when the chairman's gavel fell. On the whole, it was the dullest and drowsiest session held. Not even the chimney draft papers of Professors WEBB and WOOD could get up suction enough to draw the members to the meeting, or produce any very hot enthusiasm among those who were there.

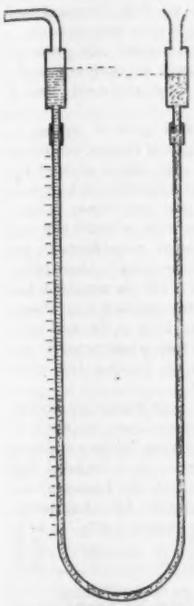
Prof. WEBB'S paper criticising the mathematical treatment of the theory of chimney draft by the French author PECLET was the first presented. According to Mr. WEBB, PECLET attempted to solve the problem by the introduction of thermodynamic formulas, and then eliminated them before he arrived at his result. The second paper, on "The Mechanical Theory of Chimney Draft," Prof. WEBB said was an attempt to show in a plain way the theory of chimney draft as ordinarily treated, considering its action as due simply to gravitation. This paper was criticised by Prof. HORACE B. GALE, of St. Louis, and Mr. G. A. GRAY, the former stating that as in practice the friction of the coal on the grate and the friction in the flues consumed most of

the energy of the draft, the theory of Prof. WEBB was of no practical account.

In the next chimney draft paper Prof. DE VOLSON WOOD supported RANKINE'S theory that a temperature of about 600° Fahr. gives the maximum draft in a chimney. Prof. GALE criticised this also, stating that observations in practice showed that the maximum draft was at about 1,000° instead of 600°. Prof. GALE also replied to the concluding chimney draft paper by WM. KENT, which was itself a criticism of a recent paper by Prof. GALE on the same subject.

About the greatest practical result of the somewhat heated discussion on this question was the drawing on the blackboard by Mr. GEO. H. BARRUS of the accompanying very neat design of an instrument for accurately measuring draft in chimneys, or indeed any slight change of fluid pressure.

The tube is filled on one side with water colored with a little aniline and on the other with some fluid oil. One end of the apparatus is inserted in the chimney, while the other is open to the air. The difference of pressure produces a difference of level of the two liquids, which is shown multiplied in the small bent tube.



The Barrus Draft Gauge.

The next paper, by Prof. DE VOLSEN WOOD, on "The Graphic Representation of Thermal Quantities," although it aroused no discussion, and but little interest, seemed to be a carefully prepared paper in a new field. The few who are interested in that subject will probably find the paper a helpful one, and can, of course, secure it in the "Transactions."

The following paper, also by Prof. WOOD, was on the somewhat new topic of refrigerating plants, and we shall try to find space for an abstract. It gave simply an account of a test of the efficiency of an ammonia machine in a Newark brewery, made by two Stevens Institute students.

The next paper, by Prof. R. H. THURSTON, on "HIRN and DWELSHAUVERS' Theory of the Steam Engine, Experimental and Analytic," was principally historical, giving at its close, however, a brief exposition of the algebraic analysis by DWELSHAUVERS of the steam engine's action.

The final paper of the evening, and one of the most valuable of all those presented during the whole meeting, was by Mr. GEO. H. BARRUS on "A Universal Steam Calorimeter." Mr. BARRUS has done a great deal to advance the science of accurate testing in steam engineering, and this last invention, which we shall soon describe and illustrate, seems as great an advance over the cumbrous old barrel method as that was over the method of ignoring entirely the moisture in the steam.

THURSDAY: EXCURSION DAY.

The continued rain of Tuesday and Wednesday had rather discouraged the members of the party who were looking forward to a pleasant holiday on Thursday, but when the morning came it proved bright and clear, with a bracing air quite unlike the damp and depressing atmosphere to which New Yorkers are accustomed. At 9 A. M. practically every member of the party had boarded the special train at the Cincinnati, Hamilton & Dayton depot, which was to carry us on our day's journeyings. The ladies were all there in holiday attire, and the not inconsiderable proportion of the members to whom the technical sessions of the convention are too much of a bore to attend, were on hand also with encouraging promptness.

The special train of six cars was drawn by the Strong locomotive "A. G. Darwin," and at every stop a crowd gathered round the big machine and examined it with much interest. The run to Hamilton, including several stops, was made in about an hour, but the ride through the beautiful scenery along the route was thoroughly enjoyed by all. At North Hamilton the train stopped at the Niles Tool Works and for a couple of hours the members of the party wandered through the works at their own sweet will.

Everything was open to the visitors' inspection, and the works are so large that the party scattered in every direction, and with no crowding or confusion everyone had a chance to look as long as he pleased at whatever interested him most. One of the things that attracted most attention, especially from the ladies of the party, was the new Corliss engine, just doing its first day's work. When the works were first established a 35 H. P. turbine water wheel was ample to furnish power, and with a steam engine put in afterward to supplement it, it has been in use ever since. Among other interesting things noticed were the ample provision of automatic oilers on the slides of heavy planers, and the cast-iron lathe spindles, showing remarkable stiffness. Everyone commented on the excellent lighting of the shop, and the arrangements for handling heavy work in the central bay. Among the things which the party stopped longest to watch were the automatic gear cutting machines, which, because of their precise working and astonishing ability to "go it alone," seemed to especially interest the ladies.

Just adjoining the Niles Tool Works are the Gordon Steam Pump Works, and these also were thrown open for the visitors' inspection.

After looking over machines and processes to their hearts' content the party assembled about the drafting and reception rooms, in the latter of which an orchestra was playing, looked over the work on the boards, the system of keeping records, etc., while some of the younger members of the party, who had read several times upon the printed programmes that lunch would be served at the works, privately canvassed the question where the lunch was coming in!

Soon, however, it was announced that the visitors were to take the train again and go out to a picnic ground near by for lunch. This pleasant news put the aforesaid younger members of the party into good humor again.

About five miles from Hamilton, on the banks of the Miami River, the Cincinnati, Hamilton & Dayton R. R. has been fitting up a new pleasure ground for picnic parties, known as Woodsdale Park, and it was planned that the American Society of Mechanical Engineers should have the distinction of being the first party to assemble there. Certainly no more beautiful or pleasant spot could have been chosen for an afternoon's outing. The grass was shaven like a lawn; a few great elms and oaks spread a grateful shade around, and the hills and trees across the river were like a landscape by CLAUDE LORRAINE. In the dining pavilion the tables were spread, and the hungry travelers swarmed in, seated themselves, and examined with much interest and surprise the elegant hand-painted menu on which were set forth the things which the Niles Tool Works had provided to tickle the palates of its guests. A basket lunch under the trees was what most of the party expected when informed that they were to go on a picnic; but here was served an elaborate banquet, with achievements in the culinary art which would have done credit to a first-class hotel, served by a battalion of nimble darkeys, who kept every want supplied.

At the head of the central table sat Mr. ALEXANDER GORDON, General Manager of the Niles Tool Works, beaming with good nature at the evident appreciation of his hospitality. As the last course was brought on he rose in response to the toast of "The Niles Tool Works," proposed by President SMITH, and in a pleasant speech thanked the society for its acceptance of the firm's invitation. As soon as Mr. GORDON finished there were loud calls for "SMITH! SMITH! OBERLIN SMITH!" In reply the President gave a brief outline of the proposition now being canvassed by a committee of the society, in company with committees from the other engineering societies, to form a federation of the societies, or "American Academy of Engineering," and stated that while no report was yet ready the committee had made some progress in its work. Mr. C. J. H. WOODBURY was then called for, and in a pleasant speech congratulated the Niles Tool Works on its present prosperity and thanked them on behalf of the society for their hospitality.

After the dinner an hour was pleasantly spent in strolling about the grounds, boating, dancing and other amusements, and the party then returned to the train for the return trip. At Ivorydale, the site of the famous soap works of Proctor & Gamble, a stop of an hour was made, and under the escort of members of the firm and the office force a tour of the works was made. Long experience with soap works of the average sort has brought about the impression that a soap works is a most unsavory place, but in these works nothing but clean fat is used, and save for a slight odor from the melting fat in the first building, no smell except from the perfume used in the soap, was noticeable anywhere about the works.

Of course the great interest centered in the production of the famous "Ivory soap." We found it first slowly boiling in great white caldrons, 20 ft. in diameter. After mixing, the soap is run into frames where it cools. The sides of the frame are then removed, and the soap stands on the truck in a large slab about 4 ft. × 2 ft. × 10 ins. In the cutting room we saw these blocks sliced by being forced against taut wires—first into thin slabs, then into long strips, and finally into rectangular cakes of marketable size These cakes were then stamped in a press, wrapped by deft-fingered girls, and one was presented to each member of the party. When unwrapped we found that each cake bore the legend, "A. S. M. E., May, 1890."

Everybody was interested in the great chimney at the works, 225 ft. high, and about 25 ft. square at the the base. The candle department, the battery of boilers, and the mixing machines, all found inquisitive spectators. Probably the thing of greatest interest at Ivorydale, however, is the profit sharing scheme which has been put in operation. At the end of each six months the net receipts above the cost of operating the works are determined. From them is taken first a dividend of 6% on the capital invested, then a salary to each member of the firm who has given his time to the management of the business, then a certain percentage of profit on the capital invested. The remainder is divided among all in the employ of the firm in proportion to their wages. At the last dividend day the amount distributed was 15⅛% on the wages paid. To impress on the employés as much as possible the importance of the saving they are making, Dividend Day is made a great holiday, with games, picnics, etc. The saloon evil, here as elsewhere, is the chief obstacle in the way of attempts to benefit the workmen. We saw none of the ordinary shop rules posted up, but in their place were many placards, of which the following are samples: "The man who is drunk the night before cannot do a profit sharer's work the next day." "Help us to earn a big dividend by saving all you can." "Remember, all you save comes back to you as profit."

Bidding good-by to Ivorydale, everybody and his or her cake of soap returned to the train and the A. G. DARWIN took us at a rapid rate back to Cincinnati.

THE RECEPTION.

Certainly the American Society of Mechanical Engineers has never met in a place better suited for an evening of social pleasure than the Art Museum in Eden Park, one of the things of which Cincinnati has ample reason to be proud. Notwithstanding the extended journeyings of the day, the members were almost all present, and even the ladies, on whom the day's jaunt had been the hardest, with one accord put off their headaches until next day, and came to the reception.

The museum is situated on the top of the bluff overlooking the business district of Cincinnati, and in reaching it most of the members of the party enjoyed a novel ride up to the inclined plane railway and thence along the top of the bluff, while the myriad lights of the city shone below them, making a scene of surpassing beauty.

Much might be said in praise of the beautiful collection of paintings, sculpture, carvings and curiosities and of the splendid building in which they are arranged. They were enjoyed to the utmost by the visitors, who notwithstanding their devotion to the utilitarian were fully competent to appreciate the beautiful as well.

A brief address of welcome was made by Hon. A. T. GOSHORN, the Director-General of the Centennial Exposition. He alluded to the great progress made by America in the decorative arts since 1876, and prophesied that at some future day mechanical engineering would have solved all the problems

set before it, including the great problem of subsistence for the masses of men, and would have accomplished its work in furnishing to men leisure to engage in the high and ennobling occupations of art and literature. In the absence of President SMITH, Mr. C. J. H. WOODBURY responded on behalf of the Society, thanking the Directors of the Art Museum for their courteous welcome.

A couple of hours were pleasantly spent in social intercourse and the party then broke up, the Eastern members, at least, understanding more fully than ever before that Cincinnati is the art center of the West.

FRIDAY MORNING SESSION.

The first paper presented was the brief but excellent one by Mr. D. K. NICHOLSON, of Steelton, Pa., reprinted elsewhere, on "Heating Furnaces."

Mr. H. H. SUPLEE then presented a paper on "Equilibrium Arch Curves," describing the system of arch construction patented by THOS. J. LOVEGROVE, of Philadelphia, in which the arch is made of the form of an inverted catenary. The paper described an easy method of obtaining a curve approximating closely to the theoretical equilibrium curve. By models it was shown that an arch with blocks of wood for the voussoirs would stand alone when a semicircular arch of the same size would fall. Mr. SUPLEE criticised the ordinary method of finding the size of voussoirs on the "middle third" principle, and Prof. OLIN LANDRETH defended it. One point which was made which seemed rather valuable was that if the joints in a semi-circular arch were made normal to the equilibrium curve, the arch would be stronger then if they were drawn to the center of the circle.

The secretary then presented the paper by Mr. THOS. C. CLARKE on the Kinzua Viaduct, built in 1882 by Clarke, Reeves & Co. The most interesting thing about this paper was the photo-lithograph of a specimen cut from one of the Phœnix columns, which showed that no corrosion had taken place on the interior of the column.

Prof. J. B. WEBB then read his paper on the "Length of an Indicator Card," which was a continuation of the paper on a similar topic presented by him at the New York meeting. Some of the members suggested that instead of correcting for the stretch of a very long cord the better way was to so arrange the apparatus as to eliminate the stretch. To this Prof. WEBB's rejoinder was that he didn't write the paper on that topic.

Prof. JACOBUS had the two closing papers of the meeting. The first, on "Influence of Steam Jackets of the Pawtucket Pumping Engine," gave an account of careful tests made by him, from which he arrived at the following conclusions:

1. The effect of jackets on the form of the expansion curves of both the high and low-pressure cylinders is so small that the errors involved in the most accurate measurements of the indicator diagrams make it impossible to show any difference in the laws governing the same.

2. The economy of the plant is about 1.7% in favor of using the flue reheater, and 2.5% in favor of using both jackets and flue reheater over that obtained when neither the flue reheater nor jackets are used. The duty for both jackets and flue heater in use was 121,560,000 ft.-lbs. per 100 lbs. of coal.

3. There was very little re-evaporation during expansion in either the high or low-pressure cylinder, the average for all the tests being 0.4% for the high cylinder, and 2.9% for the low.

The concluding paper on "The Effective Area of Screws," by Prof. JACOBUS, described experiments made on the screws of two tug-boats, and compared the results with those obtained by Prof. DENTON on the *Bergen* and the *Homer Ramsdell*.

In order that nobody might accuse the convention of having neglected the work cut out for it, the remaining "questions for topical discussion" were then taken up, although no one seemed especially anxious to enlighten the world concerning these mechanical conundrums. Questions 87, 88, 90 and 91 were propounded and received no answer. To question 89, "Should the lead increase with the load in high-speed engines?" MR. WEBBER thought that it should, stating that he accidentally discovered that a governor regulated more closely when the lead was increased.

The committee appointed to secure the establishment of a Government Bureau of Mechanical Standards reported: first, that a bill to secure the object for which the committee was appointed had been drafted; second, that it had been presented in Congress; third, that it had been referred to the Committee on Patents; fourth, that that committee had promised a favorable report; fifth, that it was impossible to prophesy what would be the fate of the bill!

President SMITH spoke again of the plan for a federation of the four great engineering societies on which a committee of 12 is now working. Messrs. THURSTON, SELLERS and TOWNE are the members of the committee from the Am. Soc. M. E. Mr. ASHWORTH spoke in opposition to the proposed scheme, declaring it to be an un-American project. He was "in favor of the American Society of Mechanical Engineers as it is," and had hoped that the scheme to amalgamate it with other societies had been permanently pigeon-holed.

The usual resolutions of thanks were liberally distributed. The local committee, with their feminine coadjutors; the hosts at Hamilton and Ivorydale, who made Thursday such a pleasant day to the visitors; the railways, which furnished transportation facilities; the various firms and societies, which had tendered their hospitality to the convention, all came in for a share. The officers, too, were suitably rewarded, and one resolution in particular, that reciting the deep regret of the members at the enforced absence of Secretary HUTTON and its sincere appreciation of the work of Mr. C. J. H. WOODBURY in filling Mr. HUTTON's place, expressed most thoroughly the sentiments of the members and was voted with much emphasis. The society is, indeed, under a very considerable debt to Mr. WOODBURY for his faithful service, without previous notice, in the very trying position of Secretary, and the resolution of appreciation was eminently appropriate.

The final session of the twenty-first meeting of the Society was declared adjourned at 12:30 o'clock, to meet in November at a place to be determined by the Governing Council.

THE CARRIAGE DRIVE.

The technical work of the convention was finished, and everybody rushed around to their hotels to get ready for the anticipated excursion of the afternoon, postponed from Wednesday. At 2:15 P. M. about 150 assembled at the Pennsylvania station, where a special train was in readiness to take the party for a little tour into Kentucky. The train steamed across the bridge into Newport, giving the party an excellent view of the muddy Ohio, up which a couple of stern-wheel boats were splashing their way, and of the bridges below. The train ran slowly along through Newport and Covington, was switched upon the Chesapeake & Ohio tracks, and crossed the fine new bridge built by that company over the Ohio River, leaving the party at the new Chesapeake & Ohio depot. Here carriages were waiting and the rest of the afternoon was spent in driving through Cincinnati's magnificent suburbs. A long climb to the top of the bluffs gave us splendid views of the business district of the city and of the winding Ohio, but the most enjoyable portion of the trip was the ride over the magnificent roads and through the well-kept grounds and parks of Walnut Hills, Clifton and Avondale. Up hills, down valleys and along smooth boulevards the long procession went, and by the time the tour was ended 20 or 25 miles had been covered and the members had obtained a good idea of the picturesque beauty of Cincinnati's suburban homes, and were better able to understand why the city has obtained a reputation for its love of the beautiful.

Most of the visitors started homeward on the afternoon and evening trains, a few only remaining over until the next day to attend the excursion to the Addyston Steel and Pipe Works.

For the Eastern members special cars were provided over the Pennsylvania R. R., and we enjoyed to the fullest extent the daylight ride over the Alleghenies, and especially up the Conemaugh Valley, which still for 20 miles shows plain evidence of the terrible flood of a year ago.

We had left the Pittsburg members early in the morning, and at various points along the line the party was further diminished, until at New York only a few of the New Englanders were left to finish the journey.

As for the results of the twenty-first meeting of the American Society of Mechanical Engineers—what they did which they ought to have done, and wherein they fell short of what they might have done—a word is said in another column. The recorder who sets down these facts will only wish that every meeting of the society may give as much pleasure to those who take part in it as did the gathering at Cincinnati in the Spring of 1890.

Minor Structures, Canadian Pacific Ry.

(WITH INSET.)

We continue our publication of the series of illustrations of the minor structures of the Canadian Pacific Ry., contributed to us by Mr. PERCY C. GIROUARD, by the accompanying illustration of the understructure of a 40,000-gallon tank, and, on the accompanying inset sheet of a standard section-house and fencing, and Howe truss bridge details.

In the tank the elevation of bottom of sills is 2 ins. above base of rail. The air chamber joists are 4 x 8 ins., the upper and floor joists 3 x 12 ins.; the sheeting and girting 2 x 4 ins.; the braces and the struts 4 x 6 ins., and the diagonal sills 4 x 12 ins. All the rest of the timber except the 9 x 9-in. diagonal caps is 12 x 12 ins. The sheeting, inside and outside, is ⅞ in., dressed, seasoned and tongued and grooved. The tie rods are 1 in., with nuts at each end, and 1 in. square drift bolts, 24 ins. long, are used for connections.

As for the details of fence and gate, of course, on so long a line there are all kinds of fences, according to local conditions, and on a very large part of the way no fence at all; but the standard fence and gate, which has been more used than any other, is that shown, viz., a four wire fence with a board cap and top board. The two alternative constructions for rock has been quite frequently necessary, there being considerable distances where fence is required, but where there is not soil enough to make it convenient to sink fence posts. The gate is a solid and good one, and proves quite satisfactory when properly put up. All depends, of course, on having the posts well set in the ground.

The section house is of a type which we should hardly like to commend for general use, in that it is so painfully bald and bare. A very trifling addition to the cost would suffice to give it a tasteful and home-like appearance. But then the house is very cheap. The following is a complete bill of material:

3 pieces 6 × 8 in.....	30 ft.	11 pieces 2 × 6 in.....	14 ft.
1 " "	22 ft.	182 " "	14 ft.
2 " "	20 ft.	112 " 2 × 4 in.....	18 ft.
60 " 2 × 10 in.....	20 ft.	70 " "	16 ft.
11 " "	14 ft.		
2 500 ft. flooring, 16 ft.		2,400 ft. bevel siding.	
4,700 ft. common sheeting.		1,700 ft. No. 2 finish.	
600 ft. beaded ceiling.		12,000 shingles.	

500 lbs. tarred paper; 530 yds. plastering; 1,750 bricks.
9 sashes, 12 × 16 in. glass; 8 lights, sash 1¾ in. thick.
4 " " " " 6 " " " "
1 " " " " 4 " " " "
10 doors, 2 ft. 6 in. × 6 ft. 6 in. × 1¾ in., 4 panels.
1 door, 2 ft. 8 in. × 8 ft. × 1¾ in., 4 panels.
5 thimbles.

The Howe trusses nearly all have the following floor: Guard rails 8 in. × 8 in., sized to 6½ in. at ties, placed 10 ft. 6 in. apart in the clear, bolted through the tie and outside stringer by ¾ in. bolts (⅝ in. × 3½ in. cast washers); ties 8 in. × 8 in., 12 ft. long, spaced 16 in. centers; every 5 ft. 4 in., or every fourth tie, guard rail, tie and stringer bolted. The ties are sized to 7½ in. at the stringers on some bridges. Six lines of stringers, all 8 in × 10 in., two under each rail, breaking joints and packed 3 in. apart. Packing bolts ¾ in. (about 5 ft. apart). The other four stringers are under the guard rails. In each panel there are four ¾-in bolts through one of the stringers and floor beam. The floor beams vary from 6 in. × 15 in. to 9 in. × 15 in.; 4 to 5 per panel, bolted through the chord by ⅝-in. bolts.

All through bridges are 15 ft. wide in clear, and, where the top lateral bracing is used, are about 21 ft. from top of rail to bottom of braces.

The dead load is generally taken 10% greater than given by TRAUTWINE for the trusses, and 400 to 650 lbs. per ft. for the floor.

Iron in tension is strained not to exceed 10,000 lbs. per sq. in. of net section; wood in tension, 800 to 900 lbs. Wood in compression, 1-6 to ⅙ breaking load, by C. S. SMITH's formula. Wood as a beam, etc., 800 to 900 lbs. per sq. in. on extreme fibres; keys, post blocks, packing, clamps, brace-blocks, are all of white oak.

The 147 ft. spans have iron clamps and lower chord post blocks. All spans of 50 ft. and over have iron brace and lateral blocks, except the 50 ft. through span. There is the same number of panels of lateral bracing as of vertical in all trusses. Much of the counter bracing is in excess. In the skeleton diagrams the height is center to center of chords, and

the length, from face to face of end post. All main rods have upset ends. Hexagonal nuts are used, with 8 to 10 ins. of thread at each end. With plates no washers are used. The lateral rods have square nuts 5 ins. of threads, all upset.

The Cam Lock Automatic Switch.

The switch illustrated herewith proposes a radical departure. Instead of having the main rails fixed and the points moveable, it proposes to make the points fixed and sections of the main rails moveable. It is obvious at once that this may have certain disadvantages when the main line is used a good deal and the switch very little, and it is also obvious that there is more complication to this switch than to the ordinary split switch; but then this switch accomplishes ends which the ordinary split switch does not. Among the claims made for it which seem to have some reasonable foundation are the following:

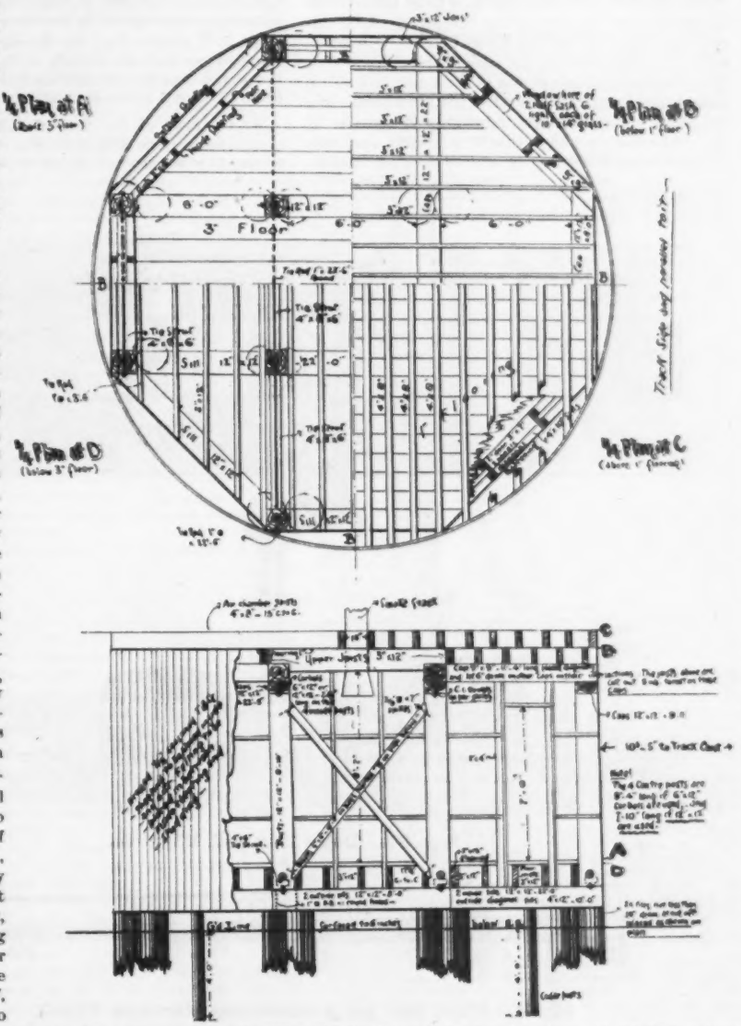
1. The points are stronger than it is possible to employ in the point switch.
2. The ends of the points are not subject to wear, and consequently should last as long as the rails themselves.
3. A few inches of snow will not interfere with the throw, the switch rails coming in contact with the points only at the extreme ends.
4. It is easy to throw, as the action of the links lifts the switch rails free from the surface plates, thus eliminating the friction.
5. The gauge directly opposite the fixed points is fixed and positive.
6. No danger can arise from a defective switch rod or stand, as the switch does not depend upon them to hold it in place.
7. If the switch is not fully thrown the weight of a train on the switch rails will complete the throw.
8. It is positive in its action and without a spring.
9. The continuity of the rail is not broken and the alignment is a tangent through the switch for both main line and siding.
10. The lead, or distance to the frog, is shortened more than 9 ft. over that of a point switch, by moving the point of departure up the track.
11. It is thrown and locked automatically when misplaced and approached by a train from the trailing end, or off-point.
12. The switch can hardly remain on a center. If approached by a train when in that position, it should invariably return to the main line.
13. There can be no danger from an imperfect throw in making a flying switch, for if it is not accomplished the remaining part of the train will follow the shunted section.

This is quite a formidable list, and we omit from it two or three other claims which seem to us clearly untenable, such as that no more repairs are required than for track where there is no switch, and that it is traversed as smoothly. These advantages are not to be expected until the millennium dawns; but, on the other hand, the switch is said to have been placed in various severe localities around Boston, and to give excellent service, both in smoothness and durability. One switch of the kind has been in use in front of the Lowell station on Causeway St., Boston, Mass., for over six years, and is said never to have needed any repairs.

The main features of the device are clear from the engravings without much description. It may be said to consist of two parts; first, the wheel-beam device, shown in Fig. and at 4 *D-f*, *D-g*, Fig. 1, for automatically throwing the switch right in front of an approaching train or car; and secondly, quite distinct from this, the ordinary switch arrangements, such as are now common to split switches.

The last, it will be seen, are two short pieces of main rail, *A A*, connected very firmly together at the head block, and throwing against one or the other of the fixed points, *M*, according to which track the train is to take. The effect of this arrangement, it will at once be seen from Fig. 1, is to begin the deflection of the wheels before the head block itself is reached, and protect the points very completely from wear. The cam movement by which the switch is thrown is shown in detail in Figs. 2 and 3. As will be seen it may be thrown in two ways, either by the wheel beams or from the switch stand, and in either case the links shown within the snow box *G* serve to lift the whole device slightly, enabling it to move free from sliding friction, and also to lock the switch in either of its fixed positions. Should it be in any way displaced from this, the mere weight of the train brings it back to one side or the other, and it is absolutely impossible, or as nearly so as any thing often is, for the device to "split" a train by moving under it. The total throw of the switch is 2½ ins., and the lift in the middle of the throw ⅛ in.

An ingenious and simple device turns the handle



Minor Structures, Canadian Pacific Railway.—Understructure of 40,000-gallon Tank.

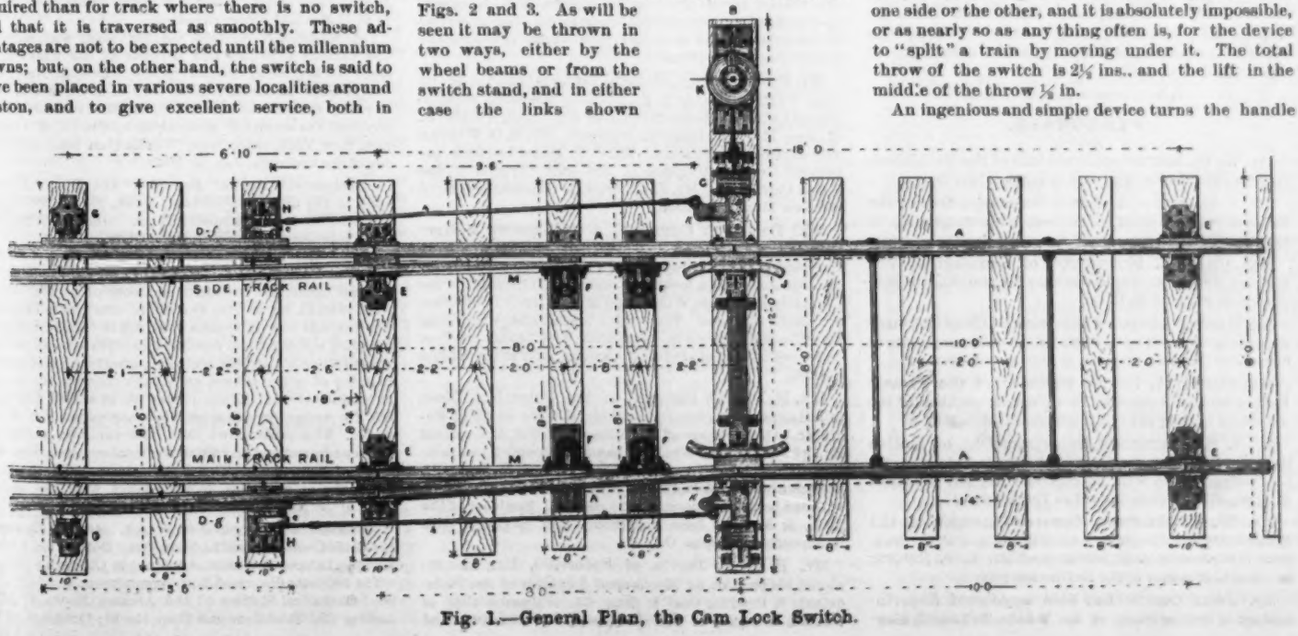
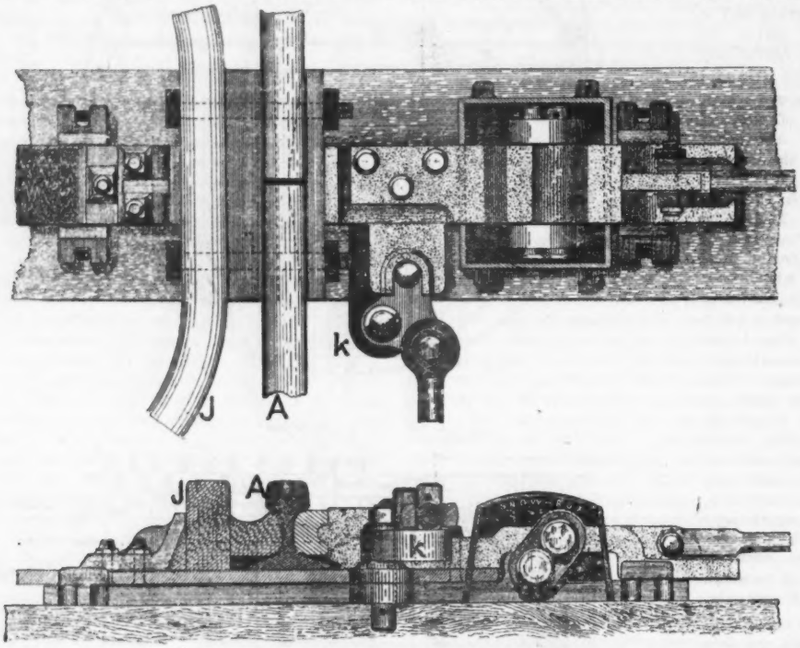


Fig. 1.—General Plan, the Cam Lock Switch.

down when the switch stand *K* is to be locked, and so disconnects it, preventing tampering with the switch while still leaving it free to move automatically when actuated by the wheel-bars, *D-f* and *D-g*. It is claimed that this action is in no case so sudden and violent as to be destructive, the movement taking place gradually while the engine is moving 12 ft. At 10 miles per hour this takes nearly a second; at 40 miles per hour, nearly a quarter of a second,



Figs. 2-3.—Detail Plan and Elevation.

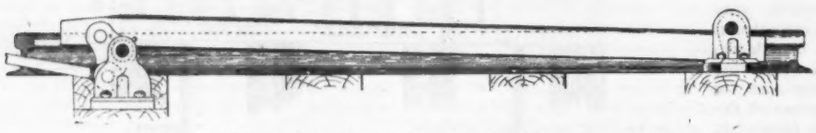


Fig. 4.—Wheel Bar for Automatically Throwing Switch.

THE CAM LOCK SWITCH.

which is lively work, yet not so very much faster than an active man might throw a switch by hand.

The device is manufactured by the Cam Lock Switch Co., 12 Pearl street, Boston, Mass. It seems to us the device is well worth a trial. It certainly has some good features, as notably the positive lock, the less liability of the points to clog with snow, the impossibility of a train being derailed by a misplacement of the points, and the probable durability of the points.

PERSONALS.

Mr. W. W. THURSTON, President of the Bethlehem Iron Co., Bethlehem, Pa., died in London May 13.

Mr. F. B. OGDEN, Assistant Superintendent of the Pekin & Peoria Union Co., has sent in his resignation, to take effect June 1.

Hon. CHAS. E. HOUGHTON, of Bennington, Vt., died last week. He was at one time Treasurer of the Bennington & Rutland R. R. Co.

Mr. HARVEY LINTON was re-elected Chief Engineer of Altoona, Pa., May 5, 1890, by the unanimous vote of Select and Common Councils in joint convention.

MR. FRANK A. LEERS, engineer of the Passaic Rolling Mill, at Paterson, N. J., and a member of the American Society of Civil Engineers, died on May 19.

Mr. J. S. PATTERSON, Superintendent of Motive Power of the Columbus, Hocking Valley & Toledo R. R., has resigned. He will be succeeded by Mr. WILLIAM MILLER, of the Vandalia road at Terre Haute.

Mr. W. F. MERRILL, General Manager of the Kansas City, St. Joseph & Council Bluffs, and of the Hannibal & St. Joseph roads, will succeed Mr. E. P. RIPLEY, as General Manager of the Burlington system.

Mr. JOHN ORTON has been appointed Superintendent of Rolling Stock of the Toledo, St. Louis & Kansas City R. R., vice Mr. T. ROBERTSON, resigned. Mr. ORTON'S headquarters are in Delphos and Toledo.

Mr. J. C. MCQUISTON, for 20 years roadmaster of the Big Four, and more recently on the Missouri Pacific in the same capacity, has been appointed Superintendent of the Cincinnati, Georgetown & Portsmouth road.

Mr. COLLINS, of the firm of Kilpatrick Bros. & Collins, contractors, of Beatrice, Nev., was shot and killed on May 13 at Pioche, Nev., by one of his employés. Mr. COLLINS was in charge of the construction of the Union Pacific extension from Frisco, Utah, west to Pioche, Nev., for which his firm had the contract.

GEN. FRANCIS A. WALKER, President of the Massachusetts Institute of Technology, has been appointed to the position of Park Commissioner of the City of Boston. Mr. Walker is well fitted for the position both in experience and ability, and will doubtless prove of great service to the public in the new enterprise connected with the beautifying of the parks.

Mr. R. J. DUNCAN, General Superintendent of the Fort Worth & Denver R. R., has been appointed superintendent of the Colorado division of the Union Pacific R. R., vice Mr. J. K. CHOATE, resigned. Mr. O. O. WINTER will succeed Mr. DUNCAN. Mr. C. F. MEEK has been appointed General Manager of the Gulf Division of the Union Pacific, and Mr. S. E. BISSELL Superintendent of the New Mexico Division.

MR. DAVID S. COFRODE, a well-known bridge-builder and contractor, died in Philadelphia on May 18, as the result of being thrown from a wagon some time ago. Mr. COFRODE was a brother of JOSEPH H. COFRODE, of the Philadelphia Bridge Works, and of DANIEL R. COFRODE, of Cofrode & Evans. These three brothers have been long and favorably known in connection with bridge erection and work of that character in various parts of the United States.

MR. R. P. VAN DEUSEN, of the Columbus, Lima & Milwaukee Ry., has resigned his position as Chief Engineer, to take charge of the Milwaukee Belt & Terminal Ry., at Milwaukee, Wis. He has also accepted the position of Consulting Engineer of the C., L. & M. Ry., with headquarters at Milwaukee, Wis. Mr. N. H. COLWELL, who has heretofore been Chief Assistant Engineer of the C. L. & M., has been appointed Chief Engineer, with headquarters at Lima, O.

Mr. E. F. C. DAVIS, of Pottsville, Pa., has resigned his position as Mechanical Engineer of the Philadelphia & Reading Coal & Iron Co. to assume that of General Manager of the Richmond Locomotive and Machine Works, at Richmond, Va. Mr. DAVIS entered the service of the Coal & Iron Co. in 1878, and when the original separate plants were consolidated and enlarged he was made superintendent. Since 1882, Mr. DAVIS has been the Mechanical Engineer of the Company. The Richmond Works, of which he will now have charge, cover 16 acres, employs 600 men, and has a capacity of 125 locomotives per year. The 8,500 horse-power engines of the new battleship *Texas* are now being built there.

Mr. T. HASKINS DE PUY, a distinguished and well-known civil engineer, died at Orange, N. J., May 15. He was born in Philadelphia, Pa., June 25, 1821. He was educated at Newark College, Del., and began his professional life in the service of the Delaware & Hudson Canal Company. A year later he entered the service of the Pennsylvania R. R., continuing there for several years. He located the Altoona section of the road and built one of the first iron bridges constructed in this country. After this he was successively President of the Catawissa R.R. Co., President of the Chicago & Fort Wayne R. R. Co., Vice-President of the Mobile & Ohio Co., and assistant to President HUGH JEWETT in the construction of the Chicago & Atlantic R. R.

PUBLICATIONS RECEIVED.

—*Report on the Extent of the First Works to be Constructed for Supplying Water to Syracuse, N. Y.* By J. J. R. CROES, C. E. Pamphlet, 7 pp. New York, 1890. Engineering & Building Record, Printers.

This is a revised edition of the report noticed in these columns Dec. 14, 1889.

—*Reports of Commissioners of the State Meteorological Bureau and Weather Service.* Albany, N. Y. Pamph. pp. 122. Pub. Doc.

An unusually readable report of unusually complete meteorological work. Those interested in its subject matter will do well to get a copy.

—*Interstate Commerce Commission Proceedings.*—Free Cartage by a Carrier: When Unlawful. Decided in this case that free cartage is unlawful when it operates as a rebate from the published schedule of rates, or when it operates to discriminate in favor of one town and against another, or secure in effect a greater charge for a short haul than for a long haul.

—*Tenth Annual Report of the Lewiston (Me.) Water Board to the City Council, with the Superintendent's Annual Report for the Fiscal Year Ending March* 1, 1890. Pamphlet, 16pp. ISAAC C. DOWNES, Superintendent.

The yearly running expenses, receipts for water, expenditures for construction, and receipts offsetting latter are given for the years 1877 to March 1, 1890.

—*Fourteenth Annual Report of the Lawrence (Mass.) Water Board to the City Council with the Superintendent's Annual Report for the Year* 1889. Pamphlet, 39 pp. A. H. SALISBURY, Superintendent.

Among other things this report gives separate classified lists of the number of consumers supplied at assessment and at meter rates, the former being 9,876 and the latter 1,213; a table of itemized summary of yearly expenditures from May 8, 1876 to Dec. 31, 1889, and very full pumping statistics for 1889, by months, with totals and averages.

—*Twenty-fourth Annual Report of the Water Commissioners of the City of Newburgh to the Common Council for the Year ending March* 10, 1890. Pamphlet, 56 pp. WM. C. MILLER Superintendent.

This report, also, contains tabular yearly statements of the various expenses and receipts of the water-works since the beginning of construction, which in Newburgh was in 1854. In addition there may be mentioned a table of yearly rainfall, by months, from 1867-8 to 1889-9, inclusive, and the results of an analysis by Prof. C. F. CHANDLER, New York, taken from Washington lake and from one of the hydrants, Jan. 25, 1837.

—*Seventeenth Annual Report of the Water Department of the City of Waltham, Mass., for the Year Ending Dec.* 31, 1889. Pamphlet, 29 pp. GEO. E. WINSLOW, Superintendent. LAROY BROWN, Clerk.

Among the interesting features of the report may be mentioned a list of leaks for the year, giving kind and size of pipe, cause, how repaired, and cost of repair. There were 10 leaks, six in 4-in., two in 6-in. and two in hydrants. The average cost of repairs was $20.41 Quite complete pumping statistics and receipts and expenses, all for the years 1874 or 1875 to 1889, inclusive, are given; also a classified list of water takers, and a table showing the number of families at each figure paying $6, $8 and $9, $10, up to $25, for water for domestic use, exclusive of house and stable. This table shows that 2,589 families, or 71%, use only one faucet and pay 49% of the total revenue from this class of consumers. The report closes with the usual summary of statistics, in accordance with the suggestions of the New England Water-Works Association.

—*Geological Survey of New Jersey. Annual Report of the State Geologist for the Year* 1889. Boards, 5¾ x 9 ins. 112 pp. IRVING S. UPSON, Assistant in Charge of Office.

The subjects discussed in this report are: Geodetic Survey; Geological Studies of the Archæn Rocks, Do., Triassic or Red Sandstone and Trap Rocks; Drainage of the

Great Meadows in the Pequest Valley, and of the Lands on the Passaic, above Little Falls; Water Supply and Artesian Wells; Publications of the Survey, Assistants and Expenses; Statistics of Iron and Zinc Ores.

About two pages only are given to Drainage, while over 20 are given to Water Supply and Artesian Wells. The water-works of the State are reviewed by C. C. VERMEULE, and especial attention is called to the fact that 11 towns, with a combined population of 455,829, or more than one-third that of the State, are dissatisfied with their present source of supply. Under artesian wells those put down in 1889 are described, and the wells at Atlantic City are described separately by LEWIS WOOLMAN. A columnar section of these wells shows in detail the character and respective depths of the various materials penetrated.

—*Formulæ for the Calculation of Railroad Excavation and Embankment*, and for finding Average Haul. By JOHN WOODBRIDGE DAVIS, Civil Engineer. New York. Published by the Author, School of Mimes, Columbia College. 8vo. Pp. 106, numerous cuts. $2.50.

This a second edition of an excellent manual on earthwork computation, which we have already noticed. It has many strong points, and is on the whole a very practical work; but the rules for computing consecutive solids together are somewhat superfluous, saving little time and being somewhat less convenient for monthly estimates, while the system of abbreviation is simply villanous. The author seems to forget that because it is easier for him to write such abbreviations as "Rule of PRIS. COR. for vols. bet. irreg. sections" it is not, therefore, easier for the reader to read it, but rather harder. He has evidently copied the fashion from Trautwine's Pocket Book, but he goes far beyond Trautwine, while he has not the same excuse, his being a thin office book in large type, while space was exceedingly valuable in the bulky, crowded pocket book. We are astonished that the author should be so ill-read in the literature of his subject as to state in his preface: "The result of the prismoidal rule is for the first time obtained by a simple correction, without calculating the mid sections of these troublesome solids." By referring to p. 36 of "Computation from Diagrams of Preliminary and Final Estimates of Railway Earthwork," by A. M. WELLINGTON, published in 1874, he will find such corrections fully explained; and this was not the first.

TRADE PUBLICATIONS.

—*The Babcock Fire Extinguisher and Chemical Engines* and *Fire Department Supplies.* Two illustrated pamphlets issued by S. F. Hayward & Co., 351 Canal St., New York, N. Y.

—*Boilers.* Illustrated catalogue of the boiler department. Taunton Locomotive Mfg. Co., Taunton, Mass.

Horizontal and vertical tubular boilers are illustrated and tables of dimensions given; also the Dean-Leavitt patent Belpaire locomotive type boiler.

—*Spirally-Welded Steel Pressure Tubes.* Illustrated pamphlet, size, 9 x 5¾ ins.; 41 pp. The Spiral Weld Tube Co., East Orange, N. J.

An interesting pamphlet containing articles by various writers, describing the method of manufacture, the advantages, and the various uses of this class of pipe.

—*Pocket Companion, containing Useful Information and Tables appertaining to the Use of Wrought Iron and Steel*, as manufactured by Carnegie, Phipps & Co. Ltd. Pittsburg, Pa. Edited by C. L. STROBEL, C. E. Edition of 1890, 12mo., pocket-book, pp. 262. $2.00.

Although in one sense a trade publication this is in another and truer sense among the most useful and indispensable engineering handbooks extant. It contains new tables for steel as well as iron, and hence all the older editions are now antiquated.

—*The New "Simplex" Ground Locking Gear for Railways:* The work it is doing and the work it can do. J. P. O'DONNELL, C. E., London, England. Price $1.50.

This is an illustrated pamphlet descriptive of a new device for railway signal interlocking purposes. It has been tried on some of the leading English railways, and is claimed to be a good point-lock, a reliable mechanical detector and an economical apparatus for safely working two junction signals (main and branch line) by one cabin frame lever. Illustrations of the device are given, and switch and signal diagrams of places where it is in use.

SOCIETY PROCEEDINGS.

Engineers' Club of Kansas City.—The club held its regular monthly meeting May 12, at the club rooms. Gen. SICKLES in the chair. The committee appointed to correspond with the American Society of Civil Engineers toward a connection with that body of the Kansas City Club, submitted its report, which was to the effect that owing to circumstances which had come to light through the correspondence with the American Society and other Engineers' Clubs it was not desirable that the affiliation be effected, as there was now talk of a national organization which would embrace every local and individual club throughout the United States, whereas the American Society was local to New York.

The report was adopted, and the committee continued, to inform the American Society of their decision and to further the proposed federation of the various clubs, and if was also suggested that when the federation should assume a more definite shape, the Kansas City Club would favor an institution with headquarters at Washington, where exists the best possible library of engineering works in the patent office and congressional libraries.

Professor FARREL, who had been invited to read a paper, could not do so, as he had been called East on business. A paper by Mr. H. SHERWOOD on "Elevators" was read. Mr. A. C. THOMPSON was elected a member of the club.

Civil Engineers' Club of Cleveland.—Meeting of May 13, 1890.

The special committee appointed at a former meeting submitted a report regarding the proposed affiliation with the American Society. The committee, consisting of Messrs. WHITELAW, HOLLOWAY, and THOMPSON, recommended that in reply to the communication from the American Society the club should state that it did not see its way clear to formulate any plans or express any views regarding the contemplated affiliation. However, it was added that the club would be glad to receive and carefully consider any proposition from the American Society. Closer affiliation might interfere with the work which each organization must do.

Another special committee, composed of Messrs. WHITELAW, RICE and BAKER, presented a memorial resolution in honor of the memory of the late JAMES S. OVIATT.

Mr. G. A. HYDE read an interesting paper on experiments in the construction of gas-holding tanks.

Prof. N. B. WOOD presented to the club a memorial of the late CHARLES LATIMER in the form of a stone tablet on which Mr. Latimer's name was carved. Applications for active membership were received from W. F. BIGGER, JOHN H. HILTON, J. C. HALLSTED, E. P. ROBERTS and W. H. DUNN.

Engineers' Club of Philadelphia.—Meeting of May 3, 1890, President H. W. Spangler in the chair.

The tellers reported that only 124 votes had been cast for and against the amendment to increase the resident dues by $2.50 per annum, to create a lunch fund, 76 votes being yeas and 48 nays. It therefore lacked the necessary two-thirds majority, but the vote was so small, that the amendment was again submitted.

Mr. Wm. H. Dechant read a paper on the Mountain Railroads of Reading, Pa. The city of Reading and its surroundings were generally described and full description given of these roads.

The paper was accompanied by a topographical map which had been made by Mr. E. V. d'Invilliers. On this map the alignments of the roads have been placed, thus giving an excellent idea of their character and surroundings. The scenery, from numerous stretches of these railroads, is grand and beautiful. Their accessibility from Philadelphia and other cities is a great advantage. They are operated in general as gravity roads usually are.

Mr. J. Foster Crowell read a paper on the Interoceanic Canal Prospect in 1890, from notes on the spot in Panama and Nicaragua. He describes the extravagant ruins of machinery and executed work which prevail along the Panama Canal, and expresses his opinion that is completion is utterly hopeless. On the other hand, he expresses every confidence in the economical and satisfactory completion of the Nicaragua route.

Mr Edwin S. Crawley presented a paper, translated from *Nouvelles Annales de la Construction*, on the Lobnitz System for the Demolition of Rocks under Water without Explosives. The principle of the system consists in producing a shattering of the rock by the action of a heavy mass let fall from a convenient height, and acting like a projectile upon the wall of a fortress.

HOWARD MURPHY, Secy. and Treas.

The New England Water Works Association.—The ninth annual convention will be held at Portland, Me., on June 11, 12 and 13. The transportation for the round trip from Boston is $5 by rail and $2 by water. Hotel rates $2.75 to $4 per day. An interesting exhibit of water works supplies will be in charge of Mr. Chas. R. Dyer, of the Portland Water Co., and to him all inquiries should be addressed The following is a list of papers to be presented:

"Is Public or Private Ownership and Management Better for the Patrons of Water Works?" Chas. W. Morse, Superintendent, Haverhill, Mass. "Biological Water Analyses," Prof. Wm. T. Sedgwick, Massachusetts Institute Technology. "Notes Made in Holland in 1877," A. W. Locke, C. E., North Adams, Mass. "Why I Favor the Use of Cement Pipe," P. F. Crilly, Superintendent, Woburn, Mass. "An Informal Talk upon the Croton Aqueduct, with Illustrations by Lantern Views," A. Fteley, C. E., Chief Engineer Aqueduct Commission, New York. City. "Water Meters; the Advisability of Their Use," G. A. Roullier, Superintendent, Flushing, N. Y. "Ground-Water Supplies," Albert F. Noyes, City Engineer, Newton, Mass. "Recording Gauges," John A. Gould, Jr., Assistant Engineer, Boston, Mass.

On June 13, by invitation of the Portland Water Co. the members will visit Lake Sebago and the two reservoirs of the company.

During the Convention the following-named topics will be discussed: 1. The effect of water-hammer upon distributing mains, and how remedied. 2. Consumption and waste of water per head, per day, in the United States, and how to best reduce waste. 3. Depth of lead necessary in pipe-joints. 4. To what extent is the use of water-meters advisable. 5. Should the meters used be owned by the water-taker? 6. What is the minimum size of mains allowable for fire supply?

For all further information address the Secretary, Mr. R. C. P. Coggeshall, Superintendent Water-Works, New Bedford, Mass.

New England Railroad Club.—At the meeting on May 14, the subject discussed was "The Length of Rigid Wheel Base Permissible on American Locomotives." Mr. Mr. F. M. TWOMBLY opened the discussion. We condense his remarks as follows:

In dealing with this question it is presumed that the minimum as well as the maximum length is in order to be considered. It is a fact that a 3-ft. wheel base has and will run successfully on a track of 4 ft. 8½ in. gauge. It is my opinion, however, that in order to get good results as regards flange wear, the wheel base should not be less than the gauge of track. The reason for this is that with more length, the tendency of the truck to get crosswise of the track is more easily checked. Following this idea, the longer wheel base the better: but of course there is a limit to this: where, I will not attempt to say.

The most trying truck that can be placed upon a curve is a 6-wheel truck with the middle pair equidistant from the other two. Your attention is now called to two curves on the road with which I am connected, around which such trucks (with an 11-ft. wheel-base) have to run, as do locomotives of the American type. The first is a 20° curve, radius 286.5 ft.; the second is 27°, radius, 212.22 ft.

To partially analyze the relations that exist between a wheel base and a curve, I have taken the curve of the radius, viz.: 212.22 ft., a 6-wheel car truck with 11 ft. base, and a locomotive of the American type, with total wheel-base of 23 ft. 5 ins., with 4-wheel truck having spread of 5 ft. 6 ins., and swing center drivers, 9 ft. apart.

The middle wheels of the car truck with no lateral motion, placed on the curve would necessarily have to overhang on inside of curve an amount represented by the versed sine of a chord of 11 ft., on a circle of the given radius, which amount is found to be 0.86 ins. In considering the locomotive, it is assumed that by reason of the swing center on truck, the engine at that point has gone over 2 ins., which I think would be the extreme limit. We then find that the amount of overhang for the forward drivers would be represented by the versed sine of an 18-ft. chord, on a circle of the given radius, which amount is 2.29 ins.

Theoretically these trucks and locomotives could not go around such a curve, but practically they do. It is obvious that they do this by difference between gauge of wheels and track, lateral motion, and straining of parts.

Over such curves trains do not run at speed. The curves in main track where trains run at speed are from 30′ to 5°, 6°, 7°, 8° and 9°. Radius of 30′ curve is 11,460 ft. Of a 9° curve, 636.6 ft.

The versed sine of an 11 ft. chord on a 9° curve is 0.29 in. Of an 18 ft. chord it is 0.72.

On some roads the maximum curves are as sharp as 15° in main track. The versed sine of an 11 ft. chord on this curve would be 0.84 of an inch. Of an 18 ft. chord 1.32 ins.

All kinds of rolling stock run successfully on these curves.

President RICHARDS referred to the subject of increased wheel loads, and the probability that the construction of heavy ordnance, just beginning in this country, might require the moving of single pieces weighing as much as 300,000 lbs. The Russian government is now building a cannon weighing 135 long tons, and this will have to be carried several hundred miles by rail.

Four guns made 5 years ago for Italy were transported by rail from Essen to Antwerp. Each weighed, with fastenings, 265,000 lbs.; the largest diameter at breech was 6.26 ft.; the length over all was 48.22 ft.; the height above the rail, when loaded on the car, was 13.23 ft.; that is, nearly as high as an ordinary smoke stack. Special cars were built to transport them, and each car took the form of our two-truck cars. On top of the car was a sort of saddle on which the gun rested on its trunnions; the saddle was supported so that the platform or body of the car could swivel, as the truck under an ordinary car; each individual car was supported by two trucks, which were like an ordinary American truck, only they had four pairs of wheels. The rigid wheel base of those trucks was 11.34 ft in length. The weight on each truck was 66,500 lbs.; and the weight on each journal was 8,312 lbs. The weight on the bridges was but little more than that of locomotive and tender.

Mr. MARDEN referred to the question of lateral play of the central axle in a 6-wheel truck. In the Pullman trucks there is a provision for lateral play; but there are cars running where no more play than that naturally provided in the M. C. B. standard box and axle is allowed. A 28-ft. car recently built by him had no extra allowance for lateral play on the middle axle, and had carried a 43-ton wire cable across the continent without any trouble.

Prof. ALLEN asked as to the usual practice with regard to widening the gauge on curves. Mr. COUGHLAN said that common practice was to widen one-half inch for each 60° of curvature. He alluded to the old fallacy that a short wheel base was necessary to safety, and described experience on both narrow gauge and standard gauge roads in which the lengthening of the wheel base had stopped derailments. Mr. MARDEN spoke of the great decrease in flange wear caused by lengthening wheel bases. All the speakers agreed that the long wheel base had permanently displaced the short wheel base on American railways.

Adjournment was then taken to the second Wednesday in September.

ENGINEERING NEWS
AND
AMERICAN RAILWAY JOURNAL.

Published Weekly at Tribune Building, New York.

Vol. XXIII. Saturday, May 24, 1890.

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EDITORS.
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ASSOCIATE EDITORS.
GEO. H. FROST.....BUSINESS MANAGER

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Advertising rates. 20 cents per line *agate measure. Schedule sent on request.* **Changes** *of advertisements must be in hand on Tuesday afternoon;* **New** *advertisements Wednesday afternoon;* **Transient** *advertisements not later than Thursday noon. The last pages go to press early on Friday, and we shall be obliged if those who fail to receive their papers promptly will notify us without delay.*

Drawings and Photographs *of all new engineering works or designs, large or small, of interest from their magnitude, novelty, or originality, as well as newly adopted* **Standard Plans** *for engineering structures or details, rolling stock, etc., are always desired for early publication. Also* **Brief Technical Notes** *of the cost or manner of executing work, tests of materials, machines or other new devices, and* **News of New Construction** *of all kinds.* **Letters** *for publication must be accompanied by the name or card of the writer.*

COMING TECHNICAL MEETINGS.

Civil Engineering Society (Mass. Inst. of Technology), Boston, Mass.—Next meeting, May 30. Secy., Clement March.

Civil Engineers' Society, St. Paul, Minn.—Next meeting, June 2. Secy., Geo. L. Wilson, City Hall.

Engineers' Club of Kansas City, Mo.—Next meeting June 2, "Municipal Surveys," D. W. Pike. Secy., Kenneth Allen, 200 Baird Building.

Civil Engineers' Club, Cleveland, O.—Next meeting, June 3, "Ferrold, an artificial stone," Dr. H. Poole. Secy., C. O. Palmer, 22 Cedar Ave.

Engineers' Club of St. Louis, Mo.—Next meeting, June 14, "Report of Committee on Collection of local data." Secy., W. H. Bryan, 309 So. 7th St.

American Society of Civil Engineers, New York.—Next meeting, June 4. Annual convention, at Cresson, Pa., in June. Secy., John Bogart, 127 E. 23d St.

Western Society of Engineers, Chicago, Ill.—Next meeting, June 5. Secy., J. W. Weston, 280 La Salle St.

Association of Civil Engineers, Dallas, Tex. Next meeting, June 6. Secy., E. K. Smoot, Elm and Austin Sts.

Engineers' Club of Philadelphia, Pa.—Next meeting, June 7. Secy., Howard Murphy, 1122 Girard St.

Master Car-Builders' Association.—Annual convention at the Hygeia Hotel, Fortress Monroe, Va., June 10. Secy., J. W. Cloud, Buffalo, N. Y.

Civil Engineers' Association of Kansas, Wichita, Kan.—Next meeting, June 11. Secy., J. C. Herring, Wichita.

New England Railway Club, Boston Mass.—Next meeting, June 11. Sec., F. M. Curtis, Old Colony R. R. Rooms in the United States Hotel.

New England Water-Works Association.—Annual Convention at Portland, Me., June 11, 12, 13. Secy., R. C. P. Coggeshall, New Bedford, Mass.

New York Railway Club.—Next meeting, June 12. Rooms, at 113 Liberty St.

Engineering Association of the Southwest, Nashville, Tenn.—Next meeting, June 12. Secy., Olin H. Landreth, Vanderbilt University.

American Railway Master Mechanics' Association.—Annual convention at the Hygeia Hotel, Fortress Monroe, Va., June 17. Secy., Angus Sinclair, 140 Nassau St., New York.

Western Railway Club, Chicago, Ill.—Next meeting, June 17. Rooms in the Phœnix Building. Secy., W. D. Crosman.

Engineers' Society of Western Pennsylvania.—Next meeting, June 17. Secy., S. M. Wickersham, Pittsburg, Pa.

Boston Society of Civil Engineers.—Next meeting, June 18. Secy., S. E. Tinkham, City Hall.

As a part of the proposed photometric tests of the various kinds of car-lighting plant, as noted in our issue of April 26, it is proposed to test all kinds of car lamps burning oil which the makers consider meritorious and desire to enter for the tests. The lamps so entered will be recorded and described as A, B, C, and D, if manufacturers so request after learning the result of the tests, which will be conducted by Mr. W. B. D. PENNIMAN, chemist of the Baltimore and Ohio R. R. A large part of the tests required have already been made; those for lamps only remain to be made. The task of selecting the proper oil lamps to represent that system of car lighting is quite too invidious a one for us or for Mr. PENNIMAN to undertake. We therefore give this public notice that all oil lamps which the makers regard as meritorious and choose to offer for test will be impartially tested on the uniform basis of (1) candle-power only, and (2) candle-power hours per gallon of oil burned. The candle powers will all be measured on the arc, and not horizontally only, measurements being taken for each 10 degrees of arc through 180 degrees below the horizontal, and the average of these taken as the candle power. Should this in any case appear to work injustice, however, that fact will be duly noted, and for the best lamps diagrams will be published, showing the exact distribution as well as amount of the light.

Manufacturers desiring that their lamps should be included in these tests will please communicate with the editor of this journal. As they will be the first accurate and general tests of this kind which have ever been made, those who have really good lamps will probably find it very desirable to be represented.

IT is with feelings of regret and something akin to shame that we notice that the American Society of Civil Engineers again had a meeting this week without a formal paper to be read or discussed. The notice issued, for the second or third time consecutively, simply stated that "discussions on subjects previously presented will be continued." It is not a pleasant task to comment on this seemingly rapidly growing poverty of interest or effort in the representative Engineering Society of the United States; but it is a fact, necessarily known to a large body of engineers, and it falls as a duty on a journal taking a live interest in engineering matters generally, and this society in particular, to say something about it.

The members of the society need a vigorous stirring up, and it is the province and the duty of the Board of Directors of the American Society to do this in no uncertain way. As we have said before, the continued life and usefulness of the society depend upon prompt and efficient action in this very matter of technical papers—the only outward evidence of the activity and purpose of such an association of technical men. This action is especially necessary when our own columns bear witness, weekly, of the growing activity of local societies, and the very creditable professional papers read at their various meetings. There is evidently no lack of subject matter to describe and discuss, but it is also evident that the local member, who is also a member of the American Society, prefers to read his paper at home. It is quite natural that he should prefer to do so under present conditions; but the parent society can and should be made so pre-eminently the head in all that pertains to engineering that it should be the duty and the profit, in every proper sense, of every engineer of standing to give it the preference.

There can only be one good reason for a failing crop of proper papers in any technical body, and that is a dearth of interest among its members in the prosperity and aims of that body. We would be very loth to suppose that this was the case with the society having the largest membership of any in this country, and embracing in its list the best known of American engineers, and we would rather believe that its membership has grown a little careless in the performance of its duties to the society, and only needs a vigorous prod from those in authority and intrusted with its welfare. The members themselves can materially assist in the good work, either by acting without waiting for the urgent call that should be issued from headquarters, or by doing some talking for themselves.

THE extent of the modern tendency to misuse the word "expert" is curiously illustrated in the following, which we have received from the president of the U. S. Civil Service Commission:

A vacancy exists in the position of expert in heating and ventilating, in the office of the Supervising Architect, Treasury Department, salary, $4 a day. The Civil Service Commission is about to hold examinations to fill the vacancy. After applications are received arrangements will be made to hold examinations at places to accommodate, so far as practicable, those who apply. All applications should be filed not later than May 31.

The subjects of the examination are: Letter writing, practical questions, drawing (free-hand) and drawing (finished work). Free-hand drawing will be weighted as one-fourth and finished drawing as one-half of the whole examination. Applicants should have a thorough knowledge of the different methods of heating and ventilating large buildings and the ability to make finished drawings of the apparatus used for the purpose. Application blanks can be obtained of the Civil Service Commission, Washington, D. C.

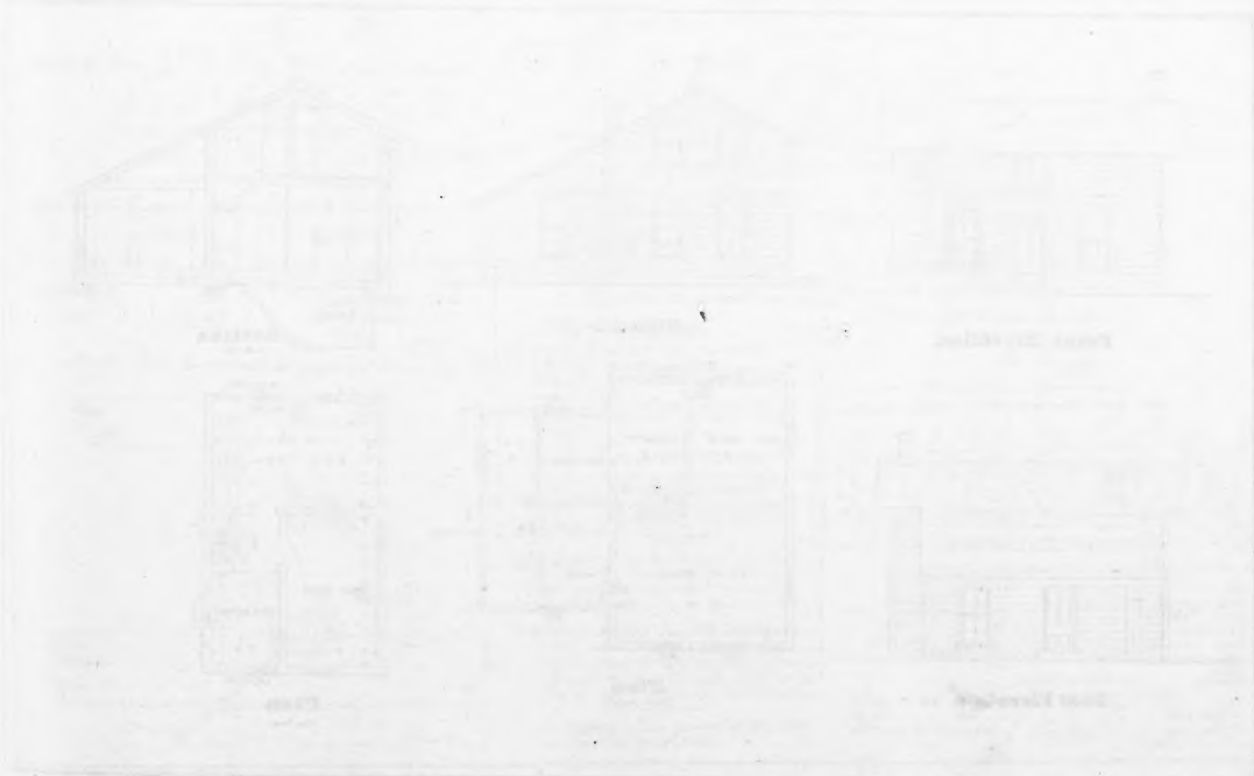
As the foregoing information will be of interest to your readers this Commission would esteem it a favor if you would announce the examination.

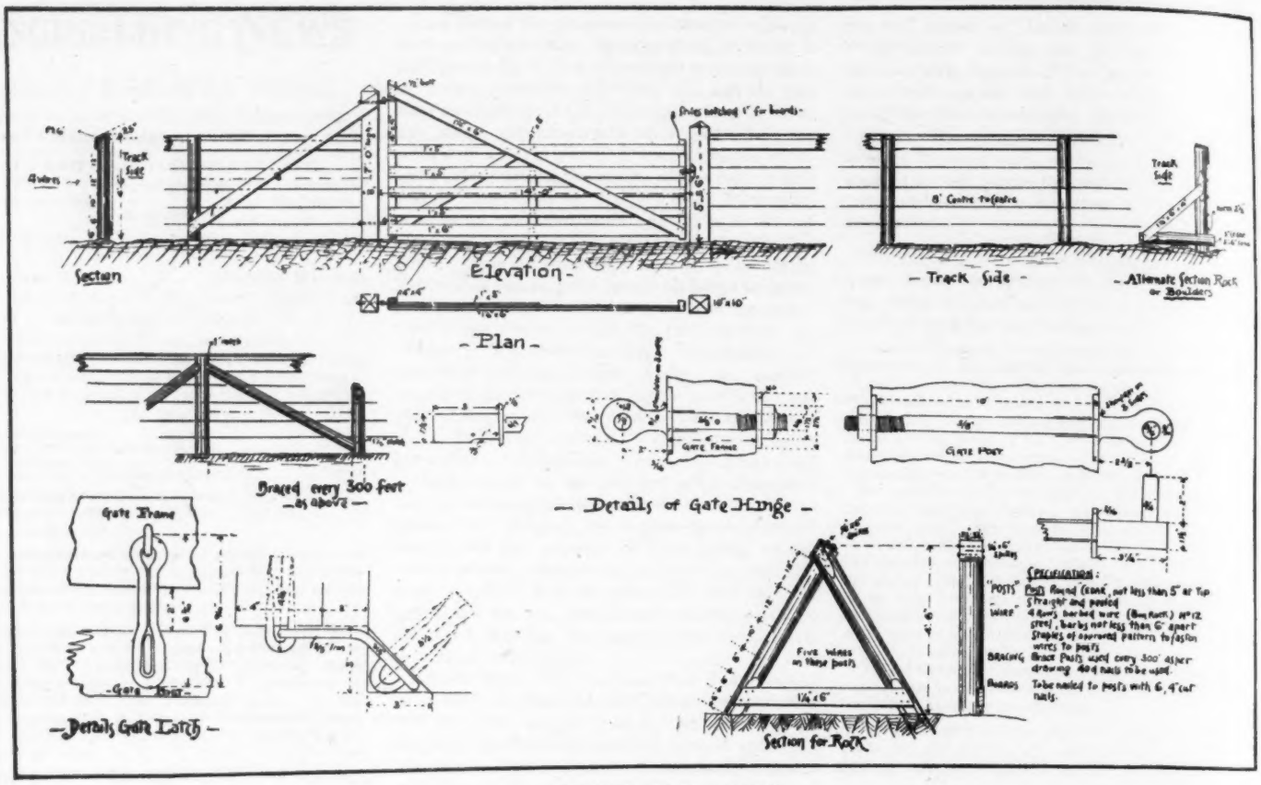
We announce it with pleasure, but we feel compelled to add that a more ridiculous way of selecting an "expert," and a more extraordinary description of his qualifications, we have never encountered. It follows directly from the terms of the notice and from the offered pay, that the commission rate this expert's qualifications as follows:

For draftsman's skill in finishing drawings	$2 per day.
For skill in free hand drawing	1 " "
For "thorough knowledge of the different methods of heating and ventilating"	1 " "
Total	4 " "

What the commission really want, and quite as much as they propose to pay for, is a fair, ordinary draftsman, with some knowledge of heating and ventilating; and why in the name of common sense could not they say so? Under the express terms of their announcement, if they live up to it, a skilled general draftsman who knows nothing at all about heating or ventilating, is more likely to get the place than the best expert in America, if he were foolish enough to apply for the place; for the draftsman would be pretty sure to get 75, while the real expert—even if his drawings were only "half bad"—could not get more than 62½.

THE irresistible tendency of the age toward centralization and "trusts" of all kinds, good, bad and indifferent, is illustrated by a proposition which is now gravely urged, and, apparently, with some prospect of success, to consolidate freight car ownership into great equipment companies controlling all the cars in large districts, as for instance, all roads north of the Potomac and east of Chicago. The idea is that the separate railways shall take the whole stock of this corporation in proportion to the number of cars turned over to it; that the entire stock of cars shall be renumbered in one series, in accordance with a uniform system, and that the whole work of distributing, repairing and keeping track of them shall be done at a great central office, the cars being portioned out each day to the several companies much as they are now portioned out on the great roads to the several divisions. Daily telegraphic reports are to be made, first from each station to a local car distributor for each line, as now; and secondly, from these officers to the central office. It is urged with much force that better service would be got out of the cars; that the cost of maintenance, waste mileage and demurrage losses





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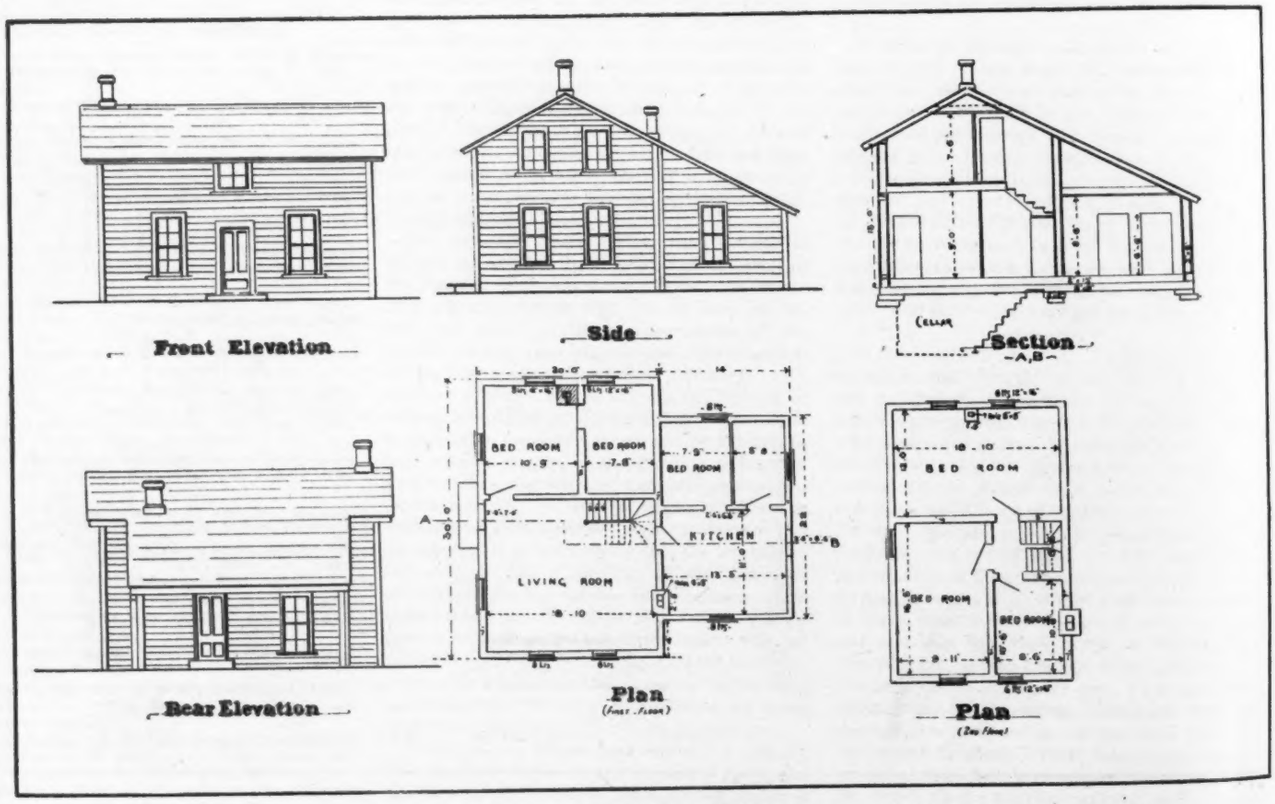

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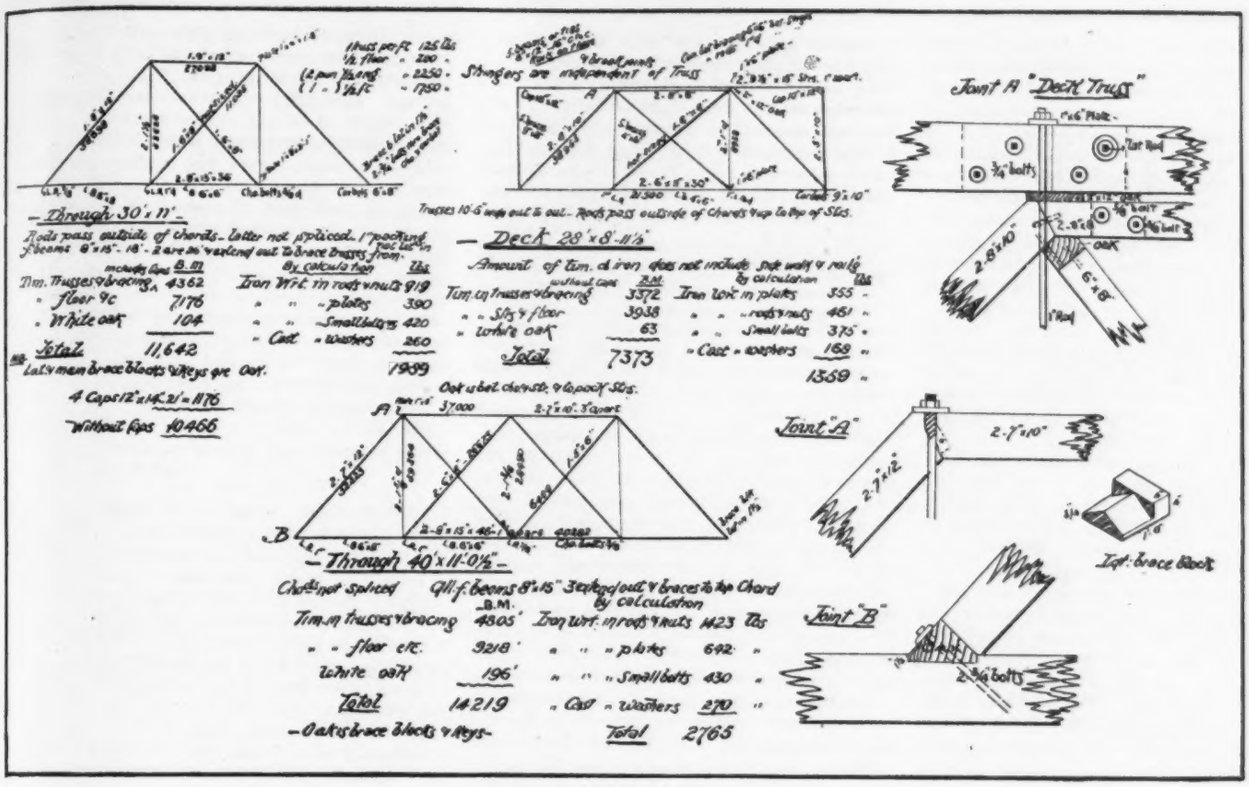
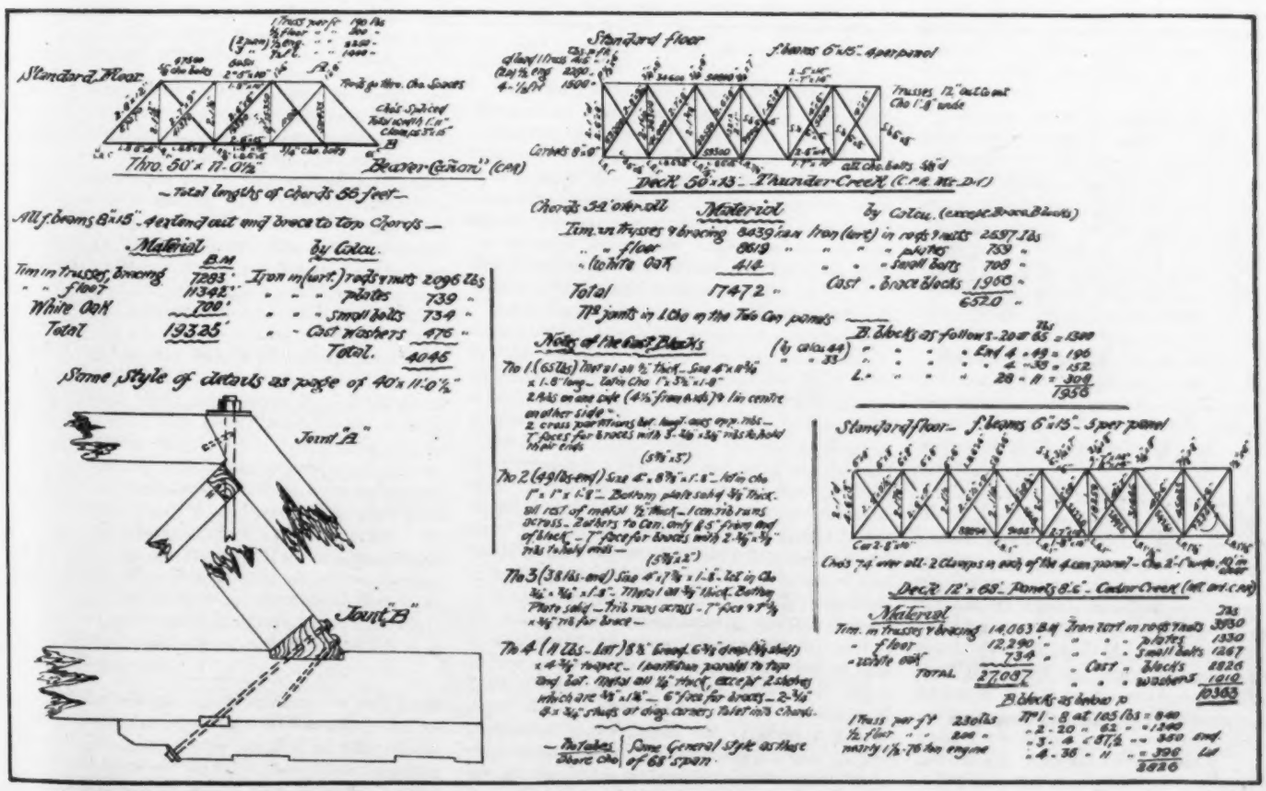


HOWE TRUSSES.

28, 30 AND 40 FEET SPANS.



HOWE TRUSSES.

50 AND 68 FEET SPANS.

would be less, while it would be greatly easier to insure use of standards. There can be no doubt that some such plan as this would have great advantages, as well as certain difficulties. But the same argument which applies to freight cars would apply almost as strongly to passenger cars and locomotives; and when carried to its legitimate extreme, ends in favoring the complete consolidation of railways in large areas under one great company, which seems to be the direction in which we are tending, and which is favored in one way or another by a good many cool-headed and competent men. This, at least, is certain, that consolidation has already gone so far as to make this further step a less violent change than are present conditions from those which obtained twenty or thirty years ago. Already consolidation has gone so far that the general manager of half a dozen systems is only a manager of managers. Putting a manager-general above them all is only a short step farther.

THE jealousy of the various "sides" of Chicago, together with the obvious natural advantage of the site, and the permanent advantage to the city of having half a square mile of new land added to its business center, bids fair to exclude from serious consideration any other site for the great fair than the central lake front site; but we question if it is duly considered how very serious a difficulty will arise from the fact that the tide of travel to and from the Fair will coincide in "magnitude and direction" with the daily tide of travel to and from business. Only a very considerable enlargement of existing facilities in all directions, together with arrangements to run trains from outside the city directly to the grounds, will overcome this difficulty, and if it be not fairly well overcome the attendance at the fair will be seriously checked. The fact that this exhibition will be kept open evenings, thanks to the electric light, will tend to minimize this difficulty, and so will the fact that most visitors to the fair will make a sort of holiday of it, and so start later than the ordinary business travel; but still, it will be a serious matter.

A CORRESPONDENT asks what present practice as to curving rails is, and especially whether it is true that the trunk lines no longer take the trouble to do so. As we understand it, few roads now curve rails for less than 3° curves, and some roads not even on 4° curves. All roads pretending to maintain good track curve them for 5° curves or sharper, so far as we know. The middle ordinate for 30 ft. rails is only ¼ in. per degree of curve, and a very slight force will spring a rail enough to give ½ in. to ¾ in. middle ordinate, so that the tendency to straighten, if the rails are not curved at all, but merely sprung into line, is very small, even with even joint track, on easy curves, and still smaller with broken joint track. But it is so simple a matter to bend rails that it would seem well to bend them even for 2° curves. As good a way as any for bending rails for easy curves, say 5° or less, is simply to drop them with some force on blocks; the tendency is then to bend evenly. Another good way is with a lever hooked under the track. No great precision is necessary. If the middle ordinate is a quarter of an inch out it is no serious matter, but when it becomes two or three times that, as in laying straight rails on 3° curves, there is certainly an awkward tendency to straighten, which it is desirable to avoid.

WE must ask our correspondents to call a halt on the subject of retaining wall formulas. An innocent little query on the subject of alleged discrepancies between them has brought us a number of letters which we cannot give space to, besides the two which appear in this issue. Moreover, we have our own pet formula, which we want to air on this occasion. It is short and simple, "3-7 of the height, and throw in some odd inches for luck," and we believe this to be more strictly and more truly "general" than any one of a number of much more complex formulas which lie before us. It is certainly foolhardy to build retaining walls much thinner than this formula calls for under any conditions, while experience indicates that any well built wall proportioned in accordance with it is pretty sure to stand. Therefore—why worry more over retaining walls? Life is too short, and art too long in other directions, to do so.

The Cincinnati Convention of the American Society of Mechanical Engineers.

The twenty-first regular meeting of this most flourishing engineering society, of which a graphic account is given in this issue, has come and gone, and it is in order to consider what it accomplished and in what way, if any, it fell short.

As regards attendance, the meeting just closed was a decided success. At one time or another probably nearly 225 members, including those resident, were in attendance. This, it is true, is not quite one-fifth the present membership; but to secure an attendance at a semi-annual meeting of 20% of the membership of a national society made up of such very busy men as the members of this society, is doing very well indeed. Attendance means to most of the members the loss of an entire week from their regular work, and the above record speaks volumes for the interest which the members of this society take in its welfare.

So far as the purpose of these meetings is to have a good time and make the members better acquainted with each other, the Cincinnati meeting was also a decided success. This is indeed one great purpose, and it might also be said to be the chief purpose of these meetings. The ideas on technical subjects that are exchanged in private conversation are often quite as valuable as those which are presented in the regular sessions, and published in the "Transactions." Bringing about the general acquaintance among the members of the profession, which will lead to this, is one of the most important results effected by all these technical societies.

Regarded merely as a pleasant relaxation, too, the meeting was a successful one. Comparisons are odious, and it would be difficult to say that the Cincinnati excursions were more or less pleasant than those at Erie, Scranton or Nashville, but it is certainly true that the visiting members were royally treated at Cincinnati, and if anyone did not have a thoroughly enjoyable time it was due merely to his *blasé* nature or to a mulish determination not to take pleasure in life.

It is as regards the technical work of the convention, however, that a few words of criticism seem in order. Are the papers that were presented at this meeting and the discussions upon them quite a fair sample of what this great national association of mechanical engineers wishes to have published as its "Transactions?" We are speaking of the papers as a whole now, and not of any especial ones. In the long run, the only criterion by which to judge of the matter presented for publication in the "Transactions" of a technical society is the semi-commercial one of whether they are read and valued, by a few at least. By this is meant simply that no money should be spent in publishing matter in a society's "Transactions" for which there is no demand whatever. This is not saying that papers of real value and importance, but on subjects of very limited interest, should not find a place there. The "dime novel" standard, of popularity, is even more out of place in a technical society than in a technical journal. There are papers which no publisher of technical books or technical periodicals wishes to publish, because the number of readers who care for them is too small, yet which deserve to be put in print and made accessible.

The American Society of Mechanical Engineers may very reasonably tax its members for the publication of matter of this sort, as well as for papers which appeal to the profession at large; but it will certainly be agreed that matter which serves only to gratify the mistaken vanity of its author, and which is neither interesting reading at the time of its publication, nor of value for reference afterward, should be relentlessly excluded by the publication committee. To print such matter in the "Transactions" not only does not help but actually injures the society's reputation. GRATIANO'S two grains of wheat were sound enough, but they were unfortunately hidden in two bushels of chaff.

There were some very good papers presented to the convention. Mr. BARUS' description of his latest type of calorimeter, and the very thorough work which is being done by the committee on uniform methods of Testing Materials are examples, and this by no means exhausts the list. Mr. D. K. NICHOLSON'S paper on "Heating Furnaces" is another example of a type of paper for which the "Transactions" should always have a place. His style of treatment, in that it is free from all verbosity, and takes up directly the matter in hand without useless prefaces, is one which writers on similar topics would do well to study.

But with all the good things written and spoken at the twenty-first meeting of the society, is it not true that a great deal of other good matter ought to have been presented there, and was not? There is too great a tendency to the purely theoretical paper, largely coming from a few writers. One can imagine the transactions of the society containing something like a fair account of the important advances in the various branches of mechanical science, and the records of original work done by members of value for instruction and reference. No one will pretend, however, that the papers presented at the meeting gave any fair account of the important advances made in the past six months or in the past year, save in a few instances. How much "blue penciling" the Publication Committee has done we cannot say, but of course, if not enough papers are presented to permit them to choose the best, they will pass papers which would otherwise be returned to their authors.

Certainly there is valuable work going on in hundreds of shops and mills of which the profession ought to be informed, but which is kept private "for business reasons." Rapid progress is being made in many lines which finds no record in the transactions. As far as possible these things ought to be remedied. For the papers presented, topics of more practical importance should be chosen, and in their presentation opinions should be sparingly given, except when the grounds on which the opinion is formed are also stated.

An especially sharp lookout should be kept by the members for misleading or dogmatic statements in the papers presented, and none should be allowed to pass without a terse written discussion setting forth the other side of the question to follow it.

We do not wish to be hypercritical. The society is doing a great and beneficent work for the profession, and doing it on the whole on an admirable system. The mode of presentation of papers and of carrying on discussions seems superior in the main to that in use in any other society. But the best system and the best efforts of the managers are only of service in directing the work which the rank and file of the membership are banded together to do. It is the individual members who must see that the technical work at the conventions shall grow better and more valuable with the growth and influence of the society.

We have felt the more free to make these criticisms on what we may call the personal-theoretical tendency of a goodly percentage of the Am. Soc. M. E. papers, because the American Society of Civil Engineers sets it such a good example in this matter. We have often had occasion to complain of one thing or another about the

management of that society, as notably the striking dearth of papers which has lately developed; but on the other hand, this great credit belongs to them: that the papers which they do publish are nearly all of a highly practical and permanently valuable character. There are very few "cranky" papers advocating individual theories or hobbies which are not based on long practical experience. Thus, to take the last complete year of the Am. Soc. C. E. papers which we have before us, 1888, the papers published may be roughly classified as follows:

1. Detail descriptions of engineering works	10
2. Results of physical experiments or experience	10
3. Results of engineering processes	4
4. Financial administration of engineering works	1
5. Theoretical analysis of results of practical experience	2
6. Descriptions of engineering instruments	1
Total papers read	28

We do not include in this summary the discussions, which in the aggregate are of at least as great bulk, and perhaps as great value, as the original papers. It chances also that in all this long list there is only *one* paper by a professor of engineering, and that a very full and valuable one (one of the two under Class 5 above) on general formulas for the weight of bridges. There is one other paper by an engineer who acts to some extent as a professor, and has that title, but as he is chiefly and constantly engaged in general practice, and his paper was a highly practical one, we do not class him as such.

Now it chances that at the late meeting of the Am. Soc. M. E. there was an almost equal number of papers, 27 in all, as per the list before us, and of these no less than *fifteen* were by professors, leaving only *twelve* by the active practitioners. We cannot undertake to make an accurate count, but according to a fairly careful count which we have made, there are only 48 professors, instructors, directors, assistant professors, adjunct professors, etc., in the entire list of 1,133 members of the society. Say there are 57, or 5 per cent. It is still entirely disproportionate that 5 per cent. of the members, or 57 persons, should be supplying 56 per cent. of the papers, while the remaining 1,067 persons, the only ones engaged to any extent in the practical work of the profession, only supply 44 per cent. of them.

The contrast becomes all the more objectionable when we consider how few persons furnished these 15 papers. They may be classified as follows: three professors had *three* papers each at this meeting, one had *two* papers, four had one each. Thus, eight professors presented 15 papers. But one other person had so many as two papers, and these were exceptionally valuable.

Now we will not attempt to classify these papers as to subject in detail. It is more difficult to do so than with the civil engineering papers; but the general fact will be clear from an examination of the list that a large proportion of the "professorial" papers were of a highly speculative and theoretical character; others of rather dubious importance, and others still spread out rather thin and promising candidates for a rather vigorous use of the blue pencil. Three or four of them, at least, on the other hand, were of real value, and we trust we need not say that we fully appreciate the fact that the "speculative and theoretical" papers are often the most valuable of all, infinitely more valuable than the thin records of dubious "actual practice," which often appear in all such publications. We will go farther, and say that the Am. Soc. C. E. has, perhaps discouraged this kind of paper too much, and would profit by giving the professors a larger scope.

But after all allowances of this kind are made, the fact remains that the overwhelming preponderance of value in the papers read at the last Am. Soc. M. E. meeting lay with the twelve papers by non-professors, and not with the fifteen papers by professors, and that the professors take too great a part proportionately in the oral as well as the written proceedings of the society.

It is not unnatural that this should be so. A professor has more time for writing than other professional men; his is the only class of scientific men which has constant practice in public speaking, so that a "five-minute rule" does not embarrass him as it does most other engineers; he is constantly engaged in study, and naturally enters on many kinds of more or less extended independent investigation, which seem to him important and new. Not unfrequently they are. But on the other hand, he has to deal chiefly with immature, inexperienced minds, and hence there is even more danger with his writings than with most men's, that "what is new is not good, and what is good is not new."

We are confident that the numerous really eminent and able men among the professors will not misinterpret or take offense at what we have said, but rather indorse it. A dozen or so of them are among our own most valuable contributors, and we should be sorry indeed to lose their aid and good will. But we can say these things with less danger of offense to individuals than anyone else can, and they need to be said. What we object to is simply the *excess* of one kind of papers, and one class of discussions, in the proceedings of the Am. Soc. M. E.

A restraining hand is needed, to check undue preponderance of any class of members in the society's proceedings and especially of the purely theoretical class, while discouraging no class. Otherwise the society itself will in the end suffer. We have been at meetings where for a whole half day nearly the whole discussion of the successive papers was conducted by professors, contending vigorously with each other as to their respective theories. This should not be.

Further Evidence as to the Durability of M. C. B. Automatic Couplers.

We present in another column an interesting letter from Mr. GODFREY W. RHODES, Superintendent of Motive Power of the Chicago, Burlington & Quincy R. R., giving the results of three months' further experience with M. C. B. couplers on that road. They having only the Janney type of coupler as yet in use on their road, the breakages of other couplers are wholly on foreign cars, and are too few to have any significance. We have arranged this record according to the same classification that was used in our former and much more extended record of coupler breakages which appeared in our issue of Feb. 15, 1890. It stands in detail as follows:

JANNEY COUPLER BREAKAGES ON THE CHICAGO, BURLINGTON & QUINCY R. R.

Mem. No.	Location of break.	First 6 mos.	Next 3 mos.	Total for 9 mos.
1	*Arm* off	6	8	14
2	" chipped		2	2
3	" cracked	1		1
4	*Lugs;* upper off	1	4	5
5	" lower off	2	3	5
6	" both off	1		1
7	" and back off		1	1
8	*Back* split	2	1	3
9	" out		1	1
10	*Face* split			
11	*Shank* off at neck			
12	" " shoulder	3	2	5
13	" " neck and shoulder			
14	" " arm " "			
15	" " through shoulder		1	1
16	" " end	1		1
20	" bolt pulled through		1	1
17	*Bracket* off	1	1	2
18	" cracked			
19	Miscellaneous	1		1
	Total broken couplers	19	25	44
	KNUCKLE FRACTURES:			
21	*Upper Lug* off	13	22	35
22	" " chipped	1	8	9
23	" " cracked	2	3	5
24	*Lower Lug* off		7	7
25	" " chipped	1		1
26	" " cracked		1	1
27	*Both Lugs* off	9	8	17
28	" " chipped	1		1
29	" " cracked		1	1
30	" broken upper most	1	3	4
31	" " lower most	1	1	2
32	*Tail* off	1	1	2
33	Miscellaneous		1	1
	Worn out		12	12
	Total broken knuckles	30	68	98

We include in this record all the "worn-out" knuckles, and also all the steel knuckles, although none of the latter belonged to the C., B. & Q. equipment, but all to foreign cars. There were 19 of these steel knuckles against only 37 iron knuckles, which would indicate a very large proportion of foreign cars on the road. But as the steel knuckles are credibly alleged to be far less durable than iron, and as the foreign breakages on the Chicago, Burlington & Quincy may have been balanced by an equal number of "Q" breakages on foreign roads, which so escape record (although they probably were not), we throw the whole of the Janney breakages into the records.

Of the precise number of couplers on the C., B. & Q., we are not at this moment advised. In our summary of Feb. 15 we included 1,183 couplers, which was certainly somewhat too small a number. There was no increase in the succeeding three months, however, the recent large orders for some 13,320 couplers not having begun to be put on until April. We will therefore use the certain total of 1,183 couplers in use nine months, to see approximately what these figures mean. It is at once apparent from the above table that there is a considerable increase of reported breakages over what were reported in the first six months; but taking the two together, we have what ought to be a pretty accurate record of failures for nine months.

Taking the 1,183 couplers in service nine months as equivalent to three-fourths of that number (887) in service one year, a brief computation shows that the C., B. & Q. breakages for this entire period of nine months stand as follows, in comparison with the general average of the records which we published Feb. 15:

	Breakages per year per 100 in service—Couplers.	Knuckles.
General average, 35,492 couplers	2 75	4.14
C., B. & Q., 887 couplers	4.96	11.10

This shows a considerable increase, whether in all respects of real significance or in part a mere temporary fluctuation, or due to an actual much greater number of couplers in service than we have assumed doesn't much matter. We will take it as it stands.

The cost of a new coupler is $8.50, about one-third of which is borne by the manufacturers, because of original defects in the castings. Of the knuckle fractures, just one-half is borne by the manufacturers, one new knuckle being exchanged for two broken ones, regardless of cause of fracture. This makes knuckle fractures cost the company $2 each. The coupler fractures will cost the company $5.67 each. On this basis the cost per year of keeping 100 couplers in service is:

4.96 couplers renewed, @ $5.67	$28.11
11.10 knuckles renewed, @ $2	22 20
Total per 100 couplers	$50.31
Total per car per year	1.0062

In contrast with these figures we need hardly do more than reprint the following as to the cost of the old links and pins from our article above referred to:

The C., B. & Q. had at the end of 1888, according to Poor, 26,130 cars. Therefore [from statistics given which

we do not again reproduce] the cost of these items per car and per 100 couplers (or 50 cars), was as follows:

	No. per car.	Cost per car. Cents.	Per 100 couplers
Links	2.33	50.9	$25.45
Pins	3.82	49.1	24.55
Drawbars	0.26	114.9	57.45
Total		214.9	$107.45

This record, therefore, shows less than half the cost per car that link and pin couplers do, and some figures from the Pennsylvania R. R., which we lately published in our editorial correspondence, show an even greater cost for the latter than do the C., B. & Q. records.

We shall watch with interest for the succeeding records of the C., B. & Q., which are likely to be as accurate as any kept, and which will hereafter, we understand, be in such form as to show where the breakages come from, and how many cars in service they represent.

CORRESPONDENCE.

Further Records of M. C. B. Coupler Breakages.

AURORA, Ill., May 19, 1890.

TO THE EDITOR OF ENGINEERING NEWS:

SIR: I enclose photographs showing our record of M. C. B. breakages and worn-out couplers on the Chicago, Burlington & Quincy R. R. for the first three months of 1890. You will note we have 30 broken drawbars, detailed as follows:

	Photos. No.	
Janney	20 to 44	25
Gould	1 to 3	3
Dowling	1	1
Hinson	1	1
Total		30

The last six months of 1889 we had 19 breakages of drawbars. In knuckles we have 74 turned in, viz.:

Janney	Iron	37
	Steel	19
	Worn-out	12
Gould		3
Hinson		3
Total		74

The last six months of 1889 we had 30 defective knuckles.

It will hardly do to tabulate these figures on the basis of cars equipped by the C., B. & Q. R. R. The number of broken steel knuckles and Gould and Hinson couplers shows that quite a proportion of the breakages are from foreign cars, as we do not yet use the Gould or Hinson coupler, or steel for knuckles. The appearance of the returns, moreover, indicate that our men had been going over their scrap piles, and that some of the present record should have been in the records of the last six months of 1889. For the next quarter we hope to have the equipment the breakages are removed from.

No additional cars were equipped during this three months with Janney couplers since last report. Commencing with April, 1890, there will be daily increases because of our order to equip 6,600 cars.

G. W. RHODES,
Supt. M. P., C., B. & Q. R. R.

"Fellows" in the Am. Soc. C. E.

TO THE EDITOR OF ENGINEERING NEWS:

SIR: In many professional organizations the class of Fellow is the highest grade of membership, while in the American Society of Civil Engineers a Fellow is one, not necessarily an engineer at all, who has subscribed $150 to the funds of the society. Such a person is authorized to style himself a F. Am. Soc. C. E., which may lead many to regard him as an engineer of high standing.

The value of these patrons to the society is to my mind doubtful, and it seems but just to the professional members of the organization that they should be classed in a grade which more clearly defines their relation to the society. They are its patrons, if anything, and it seems to me that "Patron" is a more proper classification for them if there must be any.

I do not wish to be understood as reflecting upon any of the society's members, but merely desire to suggest this as a fitting subject for consideration by the Committee on Revision of Constitution and By-Laws. W.

[The grade was one which never should have been created, and which we trust will be abolished. The society is now at least quite able to stand on its own legs, and need call no man ever "Patron" or "Fellow" for the sake of collecting $150 or any other sum from him. The grade can easily be consolidated with the present grade of associate, and this should be done.—ED. ENGINEERING NEWS.]

The Holgate Tie Plate.

ENGINEER'S OFFICE, GRAND TRUNK RY., ALLENDALE, Ont., May 9 1890.

TO THE EDITOR OF ENGINEERING NEWS:

SIR: In your issue of April 26, you describe and illustrate a tie plate, designed by Mr. CHAS. D. HALSEY, of Jersey City, and you refer to the suggestion to substitute "lugs" for the "shoulder" used in Mr. HALSEY'S plate.

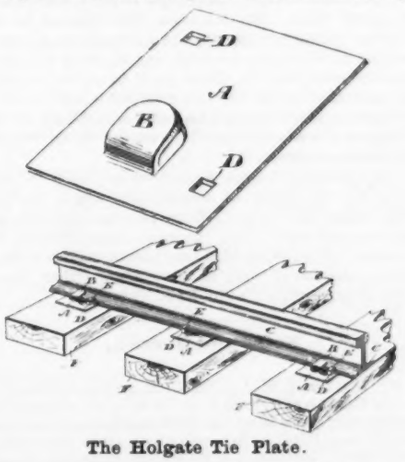
I inclose a tracing of a drawing of a tie plate introduced by me, which has been in use on this division for some time past, and which has given great satisfaction.

This plate is made of steel one-quarter of an inch thick and is 7 ins. long and 8 ins. wide. It has one "lug" and two spike holes stamped in it.

In laying these plates the "lug" is placed on either side of the rail alternately on each tie, it being thus easily removed when repairs to track require its temporary removal, and it thus in effect broadens the base of the rail.

In this section of Canada we have to use a great many tamarack, hemlock and cedar ties, and the necessity of a tie plate has long been recognized. Numerous experiments have led me to use a plate such as shown in the drawing. It is especially valuable on curves.

By using this plate we have the full life of the timber available, whereas soft wood ties have to be removed from the track long before they have become decayed, owing to the rail seat having become soft from the cutting



The Holgate Tie Plate.

of the flanges into the wood, and the constant working of the rail into the tie, destroying the hold of the spikes in time. All this a good tie plate prevents.

I found that a plate 8 ins. wide answered every purpose, a 12-in. plate becoming very soon bent.

HENRY HOLGATE.

Retaining Wall Formulas.

NEW YORK, May 18, 1890.

TO THE EDITOR OF ENGINEERING NEWS:

SIR: In ENGINEERING NEWS of May 17, the difference between the RANKINE and TRAUTWINE formulas for surcharged walls was brought up by a correspondent. The late Prof. RANKINE was fond of long formulas full of Greek letters, nevertheless he possessed a happy faculty of seeing what his involved equations would bring forth, even if no one else did. I believe that the author of the hand-book supplying one of the conflicting formulas spoke of RANKINE'S "books as little more than striking instances of how completely simple facts may be buried out of sight under heaps of mathematical rubbish." Now, as an illustration of the difference in the methods of working of the two authors, let us compare the way in which the two formulas were deduced.

TRAUTWINE begins with a retaining wall with a level backing, and, quoting MOSELY, uses the prism of maximum pressure in his formula; then, for surcharged walls, he uses a prism obtained in the same way as at first, without stopping to give any authority or reasons for the step, at least in the edition of 1886. Now RANKINE starts out with the earth in any position, and finds the general equation of pressure against a vertical wall (the modifications for a battered wall are deduced in another part of the book), then the special cases, as with a level surface, or a slope equal to the natural angle of the earth. The pressure of earth against a vertical wall he finds to be given by the following equation, when the backing is level:

$$Py = \frac{w\,x^2}{2}\,\frac{1-\sin.\,T}{1+\sin.\,T},$$

which can be reduced thus:

$$Py = \frac{w\,x^2}{2}\,\frac{1-\sin.\,T}{1+\sin.\,T} = \frac{w\,x^2}{2} \times \frac{2\sin.\,{}^1\!/_2\,(90^\circ - T)}{2\cos.\,{}^1\!/_2\,(90^\circ - T} =$$

$$\frac{w\,x^2}{2} \text{ tan. } {}^1\!/_2\,(90^\circ - T) = \text{Trautwine's formula.}$$

It was from this equation that the position of the line giving the prism of maximum pressure was determined, and *this prism can only be so determined when the backing is level.*

RANKINE'S formula for surcharged walls is correct because it is based on a general equation. TRAUTWINE'S is not, as it rests on a special case of a much more complicated problem. To show, moreover, the value of the eight pages of very easy mathematics in which RANKINE has developed the whole subject of earth pressures, let me quote from a portion (Part II., vol. I.) of WEISBACH'S "Mechanics," which has not yet been translated into English: "The formulas for a mathematical determination of the pressure of earth with a horizontal surface against a vertical wall in the general case of a sloping wall and sloping backing lead to such involved formulas that it seems better in all cases to make use of graphical determinations." In WEISBACH, the same formula used by RANKINE is deduced, although in a totally different manner. JOHN M. GOODELL,

NEW HAVEN, Conn., May 20, 1890.

TO THE EDITOR OF ENGINEERING NEWS:

SIR: With reference to the problem of Mr. FRANK PEARL in your issue for May 17, I would like to say that some time ago there was published in ENGINEERING NEWS a graphic method for finding the thrust of earth on a wall, which for simplicity, generality, ingenuity and accuracy, is superior to anything on the subject I have ever seen.

By means of it, Mr. PEARL may find in about 15 minutes that the thrust on his wall is parallel to earth surface, and equal to 4,500 lbs. The horizontal component which he asks for is 4,100 lbs., thus checking RANKINE'S result.

The method referred to was by Prof. C. E. GREENE. I, for one, would like to see it republished. Perhaps you can refer Mr. PEARL to the proper number of ENGINEERING NEWS. I cannot now find it.

I may add, in connection with the subject, that while there are four unknown quantities to be determined in the general problem, viz., direction and amount of thrust on wall and direction and amount of pressure on the surface of rupture, there are only three conditions of equilibrium. The problem is thus, strictly speaking, indeterminate, unless some assumption is made.

It is in these assumptions that methods differ. Prof. GREENE'S method ranks with the best, in that it makes but one assumption, which has to be made by all, viz., that the pressure on the surface of rupture makes an angle equal to the angle of friction at the moment of rupture. It is better than most in that it makes no other assumption. It is superior to all in the very simple, direct and general construction which is given. It should, in my opinion, replace all the hideous formulæ and complicated constructions which abound. Yours truly,

A. J. DU BOIS.

The "Pope's Bull Against the Comet."

PHŒNIXVILLE, PA., May 8, 1890.

TO THE EDITOR OF ENGINEERING NEWS:

SIR: In your last issue of ENGINEERING NEWS, May 3, 1890, while speaking of the Brooklyn Bridge trustees, there occurs a mention of the "Pope's bull against a comet," which, as you facetiously remark, ended the matter. As this "bull" is constantly recurring in a good many papers and articles in about the same connection, it seems to be assumed that everybody is well acquainted with the facts. Now, although pretty well informed in history and literature, I have never seen any facts stated of the Pope stopping a comet's career by a bull, and you would greatly oblige me by bringing to my attention any facts or references you possess about this interesting occurrence. But I strongly suspect that you will be unable to furnish any facts at all, as usual in such cases, and as happened to a worthy editor of this town when questioned about it. The remark may seem to you simply a little joke without any intended harm, but it will not strike in that light any intelligent and truth-loving catholic, among whom you doubtless number a great many subscribers, and who cannot but feel insulted at such reckless statements, which have been exploded long ago and are only a feeble relic of the palmy know-nothing days. A paper like yours of such high standard of honesty on engineering matters should keep its pages free from any such sneers, no matter how small they may seem. Hoping that you will excuse me for calling your attention to this little defect, and remedy it in the future, I remain. Yours truly,

HENRY SZLAPKA.

[We certainly were far from wishing to wound any one's feelings by this use of what has become a common colloquial phrase, but which we find, on investigation, is in its literal implication an unfounded one, although not without a certain historical origin. In *Larousse's* great "Dictionaire Universel" our correspondent will find the following (translated from IV, 698, art. *Comète*):

In 1456 the Mussulmans besieged Belgrade, which was defended by the Hungarians. "HALLEY'S comet appeared, and the two armies were seized with equal alarm." Pope Calixtus III., himself, attacked by the general terror,

ordered public prayers, and launched a timid anathema against the comet, and against the enemies of Christianity.

A friend, learned in such matters, to whom we appealed in our dilemma, sends us the following note:

The phrase was, I believe, first made popular in this country by ABRAHAM LINCOLN who, before issuing the proclamation of emancipation, expressed a fear that it would prove as ineffectual as "the Pope's bull against the comet." The phrase was so appropriate as illustrating the nature of a *brutum fulmen* that it became popular, and is now almost a proverb.

A papal *bull*, according to Webster, contains "some decree, order, or decision." It is the mandatory element which distinguishes it from other documents of papal origin. In this technical sense it is evident that no pope in his senses could ever have issued a bull against a comet. The story, under a more popular conception of the term, is not, however, without a certain historical foundation. In Newcomb and Holden's "Astronomy" we find the following paragraph under the caption "Remarkable Comets:"

"In 1456 the comet, known as HALLEY'S, appearing when the Turks were making war on Christendom, caused such terror that Pope Calixtus III. ordered prayers to be offered in the churches for protection against it. This is supposed to be the origin of the popular myth that the Pope once issued a bull against the comet." (Fifth Ed., New York, 1885, p. 405.)

In the middle ages, and later, no one doubted the baleful influence of comets Before the battle of Cappel, in 1531, some one asked the Swiss Reformer ZWINGLI the significance of a brilliant comet which seemed to hang over the city of Zurich. "It portends," he said, "my death and that of many brave confederates." That the Pope issued a proclamation, pastoral letter, or whatever else you may call it, was perfectly proper, and that it was couched in language different from that which we employ at present is not surprising. It is related by many writers that in 1479 "the army of beetles which was devastating the environs of Lausanne was solemnly tried and excommunicated in the name of the Trinity." See Baedeker's "Switzerland," (I think), Art.) *Lausanne*. This appears to us a stranger proceeding than "a bull against a comet," but it must be judged by the canons of the age in which it occurred.

A Question in Town Surveying.

GREAT FALLS. Mont., May 14, 1890.

TO THE EDITOR OF ENGINEERING NEWS:

SIR: Will you please answer the following in your next issue, or at least throw some light on the matter:

Great Falls is laid out on the square plan, with streets and avenues 80 ft. wide, except Central avenue, which is 90 ft. Alleys are 20 ft.; lots 50 x 150 and 7 in a block. Monuments were set three or four blocks apart, and recorded. Those between 2d and 5th street on Central avenue, as per sketch (not engraved), were recorded as being 1,292 ft. apart, whereas exact measurement makes them 1,292 ft., as they were set. On the next line of monuments, on the Third avenue south the excess is 4 ft. The City Council appoints a man who admits that he is neither engineer nor surveyor, and also confesses his lack of knowledge, either practical or theoretical, to the position of city engineer. It is desired to set monuments at the centers of all street intersections; when the query arose what should be done with the excess? This the city engineer decides in an arbitrary way, and concludes to set all the monuments as follows: He increases the excess of 2 ft. on Central avenue to 4 ft. to correspond with the excess on Third avenue South, and then surveys all the lots with a uniform correction, leaving the streets exact measurements. He thus sets the monuments at 5th street only 23 ft. west of the 15 ft. range stone, and actually surveys the lot A 2 ft. east of its location, as determined by the recorded monument. Now will you for the benefit of several interested here give your comment on this method and also inform me of any existing literature on this subject, or precedent examples of the correct method. I have advised the council that the error should be divided proportionately over each foot. W. E. KERN.

[Our understanding of the points involved is as follows:

1. If no lots have been sold, so that no individual property rights are affected, any liberties whatever may be taken with the monuments to make them better correspond to what the maps call for; or the entire town may be laid out anew, and a new map filed.

2. If any lots have been sold, no liberties whatever can be taken with the monuments, except by "unanimous consent." The streets must be laid out to correspond with them, whether or not it leaves them straight, parallel, or at right angles to each other.

3. The excess or deficiency between the monuments must be equitably divided, but the equities depend on certain further conditions, as follows:

4. If the lots have been described only by plot, which shows an intent to make them equal or in certain ratios to each other, the excess (or deficiency) must be divided *pro rata*, throwing none of it into the streets.

5. If lots are described by certain successive distances from a common point, each has its proper distance, so long as it is possible to give it, and that only; the excess or deficit falls on the last lot.

6. If any of the intermediate lots have been built on, and they can be shown to be in proper positions by measurements from anywhere, those lots govern, and the excess or deficit on either side of them is divided *pro rata*, if described only by plot, or according to par, 5 if described from a fixed point, the building being assumed to be at its proper place for measurements beyond it; *i. e.* if the descriptions read easterly from *A* to *B*, and some man in the middle of the distance had measured back from *B*, throwing the excess to the west of his lot, the lot next west of him could claim the excess, which otherwise would have fallen to the lot just west of *B*, provided the location seemed to have been made in good faith. But no man who chanced to be the first builder could take the whole excess to himself by enlarging his lot from say 50 to 52 ft., and hope to maintain his claim to it in equity on the ground that he left the full recorded width for each remaining lot; nor could he locate a building so as to throw the whole excess in a vacant lot in which he had an interest.

Any property holder concerned can stop by injunction disregard of monuments which in any way affect his rights. With the city engineer as is described above, this recourse seems likely to be needed. It is rare indeed that a man makes a general confession of "lack of knowledge, either theoretical or practical."—ED. ENG. NEWS.]

Notes and Queries.

MR. E. GERBER, M. Am. Soc. C. E., writes: I notice my friend NIMS gives Nebraska City as being 497 and 660 ft. respectively above mean tide level. Standard low water in the Missouri River at Nebraska City is given by the Missouri River Commission as 910.35 above mean gulf tide at Biloxi, Miss. Perhaps Nebraska City has solved the levee question? If "St. Louis City Directrix were substituted for mean tide level" it would be about right, though the lower elevation given would be 0.64 ft. below low water.

E. T. E., of Madison, Wis., asks where he can obtain the crushed quartz recommended by the American Society of Civil Engineers as "standard sand" for cement testing This crushed quartz is largely used for commercial purposes; but perhaps some of our readers can more exactly answer our correspondent's query.

MR. J. W. PALMER, Woodbury, Ga., wants information of MR. —— VIRGIE, C. E., who was in Colorado last year.

The address of R. MORLEY HARRISON, C. E., is wanted. Address M. B. Co., care of this office.

The Mekarski Compressed-Air Tramway Motor.

Among the "Reports of Consuls of the United States," for February, 1890, is one of more than usual engineering interest from Consul-General RATHBONE, of Paris. This is a report on the operation of the compressed-air tramway motor, on the Mékarski system, which has been in operation near Paris for over two years, and in the city of Nantes for a much longer period. While we have already described this system in ENGINEERING NEWS of May 12, 1888, the present report is so much more complete that we give it in full, as follows:

The advantages enumerated are:

(1) The motor does not emit smoke or hot gases, and is almost noiseless.

(2) A greater speed is attained than with horses where necessary.

(3) A special track or overhead appliance is unnecessary.

(4) Being very light, it can be easily handled on steep grades.

(5) Simple in form, it does not frighten horses; the machinery on the front platform is almost invisible from outside.

(6) A possible explosion of air reservoirs is less dangerous than of steam or superheated water.

(7) Maintenance in repair is very simple.

(8) Only one person is necessary for managing the machinery, and he is not necessarily a skilled engineer.

(9) In crowded days or times of day the number of passenger places may be easily augmented by the addition of one or even two tenders or ordinary cars, without a motor, thus making a short train.

The principle of the system is very simple. Air is compressed to 40 or 45 atmospheres; the reservoirs of the motor are charged at this pressure; the air to be used is reduced to a pressure of 5 to 10 atmospheres, and at the same time heated to a high temperature and charged with moisture in a vessel called the heater (*couillotte*): from there it passes to a double expansion engine, where it acts like steam in moving a piston rod.

The running expense of this motor per kilom tre has proved:

	Francs.
Charging and running	0.2079
Depreciation of machinery	0.1233
Depreciation of car	0.236
Total	0.3076

This is 6 cents per kil., or 9¼ cents per mile. Including all expenses, interest on track, etc., the cost of each car making 84 kilos. per day is 52.92 francs. The cost per day of a Paris omnibus in the same way is 106.57 francs. but the omnibus runs 90.7 kilos. and seats 56 people.

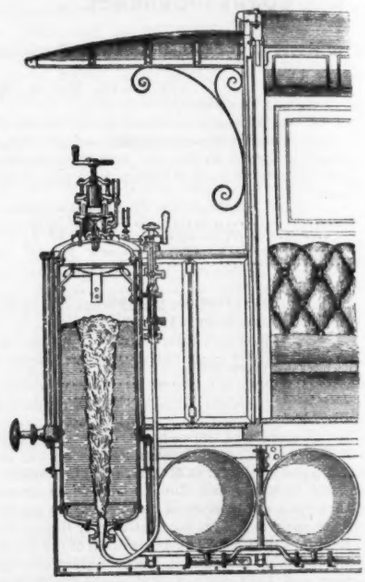


Fig. 1. Front Platform, showing Heater.

Since the Mékarski tram car seats only 38 people, the proportionate expense for the same distance and the same number of people would be

$$52.92 \times \frac{90.7}{84} \times \frac{50}{38} = 75.18 \text{ francs.}$$

Therefore, the saving in this tram system is nearly 30 per cent.

The cost of the different parts of the Nogentais tramway is as follows:

	Francs.	
Automobile	16,000 =	$3,200
Extra or tender cars	12,000 =	2,400
Reservoirs for accumulation, containing 1,250 liters	1,250 =	250
Compression pumps and engines	17,500 =	3,500
Tubular boilers, 30 sq. meters surface, 327 sq. ft.	8,000 =	1,600

The weight of tram is, when empty, 7,500 kilos. (8¼ tons) and 10,300 kilos. (11⅓ tons) with 40 passengers.

The co-efficient of friction, ordinarily 17 to 12% on tramways, goes occasionally down as low as 10%, or even 8%. However, by the use of sand, for which there is an arrangement, a friction of 15% can always be depended upon. The steepest grades on the line are 0.045 and 0.052 At one place the grade is 0.017 on an average for 870 ft. These steep grades are only justified by the absolute impossibility of changing the profile of the streets themselves. The minimum radius of curvature on the line is 40 meters (133 ft). The car is designed to go round a curve of 35 meters (116 ft), however, without difficulty.

The resistance on such heavy grades, allowing for both friction and inclination, is 55 kilos. per 1,000 (110 lbs per ton). An empty motor can therefore draw up this incline—

$$\frac{7,500 \times .15}{.055} = 20,500 \text{ kilos.}$$

that is, 20,500 — 7,500 = 13,000 kilos. besides itself. In other words, it is capable, easily, of drawing two extra carriages of 6,000 kilos. (6⅓ tons) gross weight each. If the motor is full, the extra friction will admit of its drawing proportionately more—15 tons at least. This doubling or tripling the carrying capacity is very advan-

tageous, because it does not add to the number of employés working, and very little more air is consumed. Below is shown the amount of air used per unit of distance:

The reservoirs of compressed air are separated in two sections—the battery and the reserve; on leaving the station both of these are charged with a pressure of about 40 kilos. per sq. centimeter (40 atmospheres). After the complete run, that is, 12 kilos., the pressure of the battery is diminished by 26 atmospheres, and that of the reserve by 8. As each atmosphere of pressure corresponds to 2.5 kilos. of air in the battery, and to 0.8 in the reserve, the total weight of air used is $26 \times 2.5 + 8 \times .8 = 71.4$ kilos., or about 6 kilos. of air per kilo. (21 lbs. per mile). With an additional carriage in connection, it has been found that only 1.5 kilos. per kilo. (5¼ lbs. per mile) extra is required. Thus, in doubling the number of places the loss of air is raised only 25 per cent.

In comparing this system with the alternative of an ordinary small-sized steam locomotive, M. Mékarski shows that in an ordinary economical locomotive 2.5 kilos. (5.5 lbs.) of coal are used per horse-power; also that the proportion of work to force generated in a compressed air motor ought to be at least 40 per cent., in order that it shall be as economical as a steam locomotive. This state of affairs could be realized by using a stationary engine using 1 kilo. (2.2 lbs.) of coal per horse-power, an object easily attained.

To compress 1 kilo. of air in a reservoir at a pressure of 50 atmospheres, theoretically 62,400 kilogram meters are used if the compression is adiabatic, or 32,950 if it is isothermal. Practically, the operation is effected at intermediate conditions, and needs about 48,000 kilogram meters of work. The lost work in this operation may be calculated at 25 per cent. of this, or at 12,000 kilogram-meters, making the total work necessary 60,000. On the other hand, 1 kilogram. of air at a pressure of 10 atmospheres, the pressure at which the air is used, occupies a volume of 119 liters (31.44 galls.), and can furnish, with an expansion of 6 volumes, a force of 28,900 kilogram meters. Reducing this to 24,000 to allow for lost work, it is seen that the available work is $\frac{24000}{60000}$, or 40per cent.

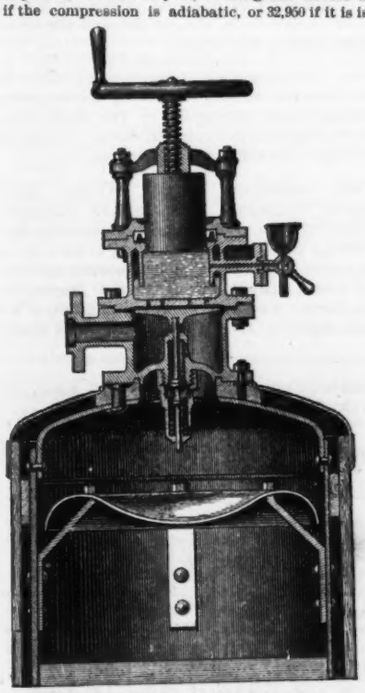


Fig. 2.—Pressure Regulator.

In this calculation the pressures are somewhat higher than are used in the tram-cars, for it was made in designing a larger motor; nevertheless, the proportion of pressures remains the same, and the result compares exactly with the practical results shown in working the tramway at Vincennes.

It might be added that the coal used for the large stationary engine is of a very inferior quality and price to that ordinarily used in small locomotives used for the same purpose, and that they, in their turn, use more coal in comparison to their power than is used in regular railroad service. The high pressure at which the air reservoirs of the "automobile" are charged is the result of the necessity to compress a sufficient weight of air in a moderate compass.

As regards the carriage or passenger part of the car this is exactly similar to all French tram-cars, having an interior part and an upper part, or "imperial." This carriage is 8 meters (26 ft. 3 ins.) long by 2.1 meters (6 ft. 11 ins.) wide. The steps at the back are arranged to make a connection with the extra car when attached. There is also here a pipe connecting with air brakes in the last car Parallel to the axles of the wheels of the tram are placed the air reservoirs, nine in number, divided into two groups intended to carry the compressed air. These are made of steel 12 millimeters (one-half inch) thick, and are tested for 60 atmospheres. The first of these two groups is composed of six reservoirs, having a total volume of 2,030 liters (536¼ galls.); the second group of the remaining three reservoirs, called the reserve, contains 1,066 liters (281¼ galls.); the total capacity, therefore, is 3,106 liters (817¾ galls.) This volume of air at 45 atmospheres weighs 170 kilos. or 380 lbs. The battery and the battery and the reserve are made independent, in order that the reserve may always be kept at high pressure, so that an extra powerful effort may be given to the engines in case of need, even at the end of the trip. The different reservoirs of each group are connected by a strong and permanent system of piping. Both groups send their air by pipes to the lower part of an apparatus called the heater. This apparatus is the most characteristic of the Mékarski system; and the need of some such appliance will be directly seen from the following calculation:

In considering the expansion of a gas, the proportion of the volumes before and after expansion being $\frac{V_0}{V_1}$, and the initial temperature being t_0, the temperature at the end of the expansion is

$$\frac{273 + t_1}{273 + t_0} = \left(\frac{V_0}{V_1}\right)^{.41}$$

In the present case $\frac{V_0}{V_1}$ being one-sixth, we find

$$\frac{273 + t_1}{273 + t_0} = .48.$$

If, by example, air is introduced in the cylinders at the temperature of 15° C. (59° F.), it would go out theoretically at −135° C. (−211° F.). Outside of the necessity of preventing the moisture in the expanding air from freezing up the cylinder-valves, etc., we find it advantageous to have the initial temperature as high as possible. For the work done is given by the expression

$$Tm = (273 + t_0)\ [29.28\ (1 - \frac{P^1}{K P_0}) + 73.3\ (1 - K^{.41})]$$

In this expression, Tm is the work effected, t_0 the initial temperature in degrees Centigrade, P^1 the resisting pressure, P_0 the initial pressure and K is the proportion $\frac{V_0}{V_1}$. Therefore $(273 + t_0)$, or, in other words, the absolute temperature should be made as large as possible.

If the value for which the temperature of the escaping air is to be 15° C. (59° F.), it is found that the initial temperature should be 327° C. (620° F.), as calculated for theoretically dry air. To avoid any such inconvenience in using air at such a high temperature, and also the necessity in such a case of having some sort of a furnace, the principle in this system is to saturate the air with moisture at a much lower temperature, taking this moisture from the hot water inside the "heater." The vapor in the air during the expansion is partially condensed, and this part, giving up its latent heat to the air, acts to greatly moderate the decrease in temperature.

The heater (see Fig. 1) is in form a cylindrical reservoir placed vertically on the forward platform of the train. It also is made of steel, and contains 200 liters (53 galls.) of water under pressure and at a temperature at the outset of 155° C. (311° F.). The air passes through the water in the heater in bubbles and becomes heated, and at the same time saturated with water. It collects here in the top part of this cylinder, which serves in the machine the purpose of a steam dome in a boiler. This part contains a curved piece of sheet-iron which forms a sort of splasher.

The regulator of the pressure ("détendeur," see Fig. 2) which the engineer manœuvers to change the pressure of the air going to the cylinders, is on top of the heater. It is a very ingenious apparatus serving to expand the air to the pressure from which it is found in the reservoirs to that at which it is to be used in the cylinders. This pressure, normally 4 or 5 atmospheres, on up grades is sometimes increased to 15, and on down grades reduced to nothing, the supply cut off, and the tram left entirely to run by gravity. This regulator is composed of two brass chambers superposed and separated by a rubber diaphragm. The first forms a hydraulic press, in which a piston descending compresses water in an annular space where a small quantity of air is confined. This cushion of air is compressed and plays the part of a spring, by which the necessary tension is easily given to the water.

[*To be continued.*]

Kerosene in Steam-Boilers.*

The paper on this subject by L. F. Lyne, (Vol. IX., page 247, Trans. Am. Soc. M. E.) induced me to give the oil a trial in the boilers of the steam heating plant of the state agricultural college, at Lansing, Mich.

The boilers experimented on are of the ordinary tubular type, each being 12 ft. in height, four are 4 ft. in diameter each, and the remaining two each 5 ft. in diameter.

The use of the oil was commenced in April, 1889, with the boilers very badly incrusted with a hard scale. Previous to this time the only method used to remove the scale had been by employing a workman to go inside the boiler and knock off what could be reached with a hammer and scaling iron. The estimated cost of this method of cleaning was $18 to $25 per annum for each boiler, and the results were very unsatisfactory, as more than two-thirds of the heating surface was entirely inaccessible. The scale was fully ⅜ in. thick in many places.

The first application of the oil was made while the boilers were being but little used, in the warm season, by inserting a gallon of oil, filling with water, heating to the boiling point and allowing the water to stand in the boiler two or three weeks before removal. By this method fully one-half the scale was removed during the warm season, and before the boilers were needed for heavy firing. We found, however, that a more effectual way was to apply the oil in small quantities when the boiler was in actual use. There is no question regarding the action of kerosene oil in softening the particular scale deposited from the water which we use (an analysis of that water is appended), and it also seems to work in between the scale and the boiler plate in such a manner as to loosen large flakes of the scale, sometimes fully a foot in length. On opening the boiler they are found deposited on the bottom, and readily removed by rakes. The great mass of the scale, however, is removed as a fine mud, through the blow-off pipe.

In regard to the quantity to be used, we found that beyond a certain amount no benefit seemed to result; for boilers 4 ft. in diameter and 12 ft. long we obtained the best results by the use of one-half gall. for each boiler per week, and for each boiler 5 ft. in diameter, 3 quarts per week.

The oil was readily fed by adding a one-fourth inch branch to the suction pipe of the feed pump, and leading it to a vessel containing kerosene oil. By this method a quantity as large or small as desired could be introduced into the boiler at the same time with the usual feed, and in the form of an emulsion of water and oil.

At the present writing our boilers have less scale in them than at any previous time during the past four years, and the small amount running in them seems to be soft and gradually disappearing. A large portion of each boiler shows the clean black steel, apparently in as good condition as when new.

I do not believe that the oil will produce any injurious effect on the iron—in fact, I cannot see why it is not the best possible preservative for it.

Our boilers are some distance from the various buildings heated, and steam is transported through underground pipes; the extreme distance being about 800 ft. in opposite directions. Despite the small quantity of kerosene used in the boilers, the odor was perceptible by opening an air valve to any steam radiator in any of the buildings.

When as much as a gallon per week per boiler was used, the odor was very strong, but with one-half that amount it was hardly perceptible, and only to be noticed when an air valve had been open a long time.

Since commencing to use the oil a much greater deposit of rust scales than usual has been found in the various steam traps in the buildings, indicating, in my opinion, that the oil is also exerting a cleansing influence on the pipes of our whole system.

The expense of this oil is very light, as compared with any other preparation for cleansing boilers known to the writer. The expense to the college per boiler has not exceeded $2 per annum for the kerosene used.

The water used in our boilers is obtained from a flowing well having a depth of 260 ft. The following analysis, by Dr. R. C. Redgie, shows its composition:

$CaCO_3$, (Carbonate Calcium	206 parts in 1,000,000
$MgCO_3$, (Carbonate Magnesium	78 " " "
F_2CO_3, (Carbonate Iron	22 " " "

Traces of sulphates and chlorides of potash and soda.

Total solid parts, 325 to 1,000,000.

* A paper by R. C. Carpenter, Prof. of Engineering, Michigan State Agricultural College, read at the Cincinnati meeting of the Am. Soc. M. E.

To Estimate "Round Log" Structures.

A late issue of this journal contained a query as to the best method of estimating, in feet board measure, the round logs sometimes used in various structures. Mr. M. J. Butler, C. E., of Fraserville, Quebec, answers as follows:

The easiest method is to multiply the number of cubic feet in the log by 12, which at once gives the quantity of feet board measure. But if it is desired to know the number of feet B. M. that a round log will make, the following rule agrees with the usual saw mill practice, excepting only mills where bandsaws are used:

From the diameter of the log, in inches, subtract 4 and multiply the remainder by one-half of itself. Multiply this quantity by the length of the log, in feet, and divide by 8. The result will be the number of feet board measure in the log. Taking as an example a log 20 inches in diameter and 13 feet long, we would have $20 - 4 = 16$, $\times 8 = 128$, $\times 13 = 1664$, $\div 8 = 208$ ft. B. M.

Method for Finding Depth of Half Area of Trapezoidal Section.

BY WM. MICHEL, ASST. ENGR., C., H. V. & T. RY.

The problem is presented: How deep must the water be in a ditch or basin having a cross section like Fig. 1 in order that it may be half full. Inverting the figure for the sake of clearness, and producing the lines $A\ B$ and $C\ D$ to the intersection E, as in Fig. 2, thus completing the triangle, the problem may be solved by the formula for cutting from a triangle a given area by a line $G\ H$ parallel to its base:

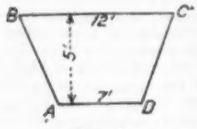


Fig. 1.

$$E\,G = E\,H\sqrt{\frac{E\,G\,H}{E\,A\,D}}$$ $E\,G$ having been found, subtract it from $E\,A$ and get $A\ G$. Then *cos.* $G\,A\,Y \times A\,G = G\,Y$. The total depth of basin—$G\,Y$ = the required depth $B\,X$.

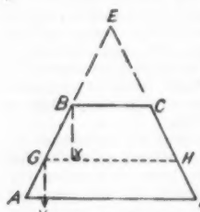


Fig. 2.

As an example of this method in practice, take Fig. 3, having the same dimensions as Fig. 1.

First find $E\,M$ = *cot.* $E\,B\,M$ 3.5 = 7, 3.5 × 7 = 24.5 = area in sq. ft. of triangle $E\,B\,C$. Next find $E\,N$ = $E\,M$ + depth of ditch, 5 = 12 ft. $A\,E = \sqrt{E\,N^2 + A\,N^2}$ = 13.416 ft. It can be seen that the area of the end section of the basin is 47.5 sq. ft., half of which is 23.75 sq. ft., the required area to be cut off the triangle; then this area + the area of the triangle $E\,B\,C$ = 48.25 sq. ft. Use this for the numerator of the fraction in the above formula and the area $E\,A\,D$ = 72 sq. ft. for the denominator, thus.

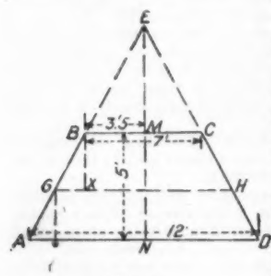


Fig. 3.

$$E\,G = E\,H\sqrt{\frac{48.25}{72.0}} = 10.982 \text{ ft.}$$ $A\,E - E\,G = A\,G$ = 2.434 *Cos.* $G\,A\,Y \times A\,G = G\,Y$ = 2.176 ft. Then the total depth of basin — $G\,Y$ = 2.824 ft., the depth of water when half full. Then to check this operation multiply *tan.* B by this depth and get $G\,X$ = 1.414 ft. This multiplied by depth = 3.992 sq. ft. Adding $B\,X \times B\,C$ = 19.758 sq. ft., we have 23.75 sq. ft., the required area in $B\,G\,C\,H$.

The Canadian Pacific's Annual Report.

The position of this company as the only competitor of the railways of the United States in the Pacific Coast traffic, makes its annual report of especial interest. The results of operations for the last four years are as follows:

	1886.	1887.
Gross earnings	$10,081,804	$11,606,413
Operating expenses	6,378,317	8,102,295
Net earnings	$3,703,487	$3,504,118
Per cent. op. exp. to earn.	63.26	69.81
Fixed charges	$3,068,042	$3,250,264
	1888.	1889.
Gross earnings	$13,195,536	$15,030,060
Operating expenses	9,324,761	9,024,601
Net earnings	$3,870,775	$6,006,059
Per cent. op. ex. to earn.	70.66	60.04
Fixed charges	$3,544,351	$3,779,133

The results of the year's business fully bear out the expectations of the management. This is especially gratifying considering the partial crop failure of Manitoba and the Northwestern provinces and the light wheat crops of Ontario. This falling off in the local grain traffic necessitated the movement of a large quantity of less paying freight, which accounts in a great measure for the decreased earnings per ton-mile. The business of the Short Line across the State of Maine has been generally good and the traffic interchanged with the Minneapolis, St. Paul & Sault Ste. Marie and the Duluth, South Shore & Atlantic railways has assumed such large proportions that the company will take steps to make the present arrangements with those lines permanent. During the year the contract with the Imperial Government was concluded providing for a mail subsidy of £60,000 per year for the proposed mail route between Vancouver, B. C., and Japan. The income from the sale of the company's lands amounted to $731,194.

The following extensions were completed wholly or in part during the year: London to Windsor, Ont., 112 miles; Brandon to Souris, 17 miles; Barnsley Branch, 6 miles; Regina, Alberta, northwest, 150 miles. The Regina extension will be further extended during the present year to Prince Albert, 100 miles. The Brandon Branch will also be completed about 50 miles further this Summer. It is expected that the extension of these lines will largely increase the grain traffic of the company. Both lines pass through the midst of the wheat-growing section of Manitoba and the Northwest Territory.

The company will seek to prevent the invasion of its territory by competing lines by constructing at once various feeders in British Columbia and the northwestern provinces. In furtherance of this policy the company has secured a charter for the Columbia & Kootenai Ry. Co., which will build a 30-mile line to the head of Kootenai Lake, and has leased the lines of the proposed Calgary & Edmonton, the Shuswap & Okanagan, and the Montreal & Western Rys. The Calgary & Edmonton Ry. Co. proposes to build a line from Calgary to Edmonton, N. W. T., and will construct about 100 miles of the line this season. The Shuswap & Okanagan Ry. is to run from the main line to the head of Okanagan Lake, a distance of 51 miles. These two lines of railway will open up the greater part of British Columbia south of the main line and give the company access to a rich mineral and timber district. The Montreal & Western Ry. is being built from St. Jerome, P. Q., west, and will penetrate a good agricultural country.

Among the other improvements of the current year the most important will be straightening and reducing the grades of the main line between Carleton Place and Callander, Ont., 195 miles, the completion of the terminal facilities at Montreal and Toronto and a large amount of general repairs to the roadbed and track.

The report calls attention to the fact that it will be 10 years on Oct. 21, 1890, since the contract for the construction of the line was le', and that the contract date of completion was to be May 1, 1891. The present prosperous condition of the road, which has now been completed four years, fully justifies the pride which the Canadians take in their most important railway enterprise.

THE MAIN ST. ARCH, in Springfield, Mass., is to have its parapet wall reduced from 12 ft. to 5 ft. This is the outcome of a long controversy in which this journal has taken some part. But the *Republican*, of Springfield, led in the crusade, and is practically entitled to the credit of abolishing a feature which would have been about as ugly as it was unnecessary.

THE CONSTRUCTION OF THE FOLSOM DAM across the American River at Folsom, Cal., has been delayed by high water, and the secretary of the company is reported as stating that work cannot be resumed before September. About three months' work is still required to complete it. The dam is being constructed to impound water for furnishing power to saw-mills, etc., to develop the extensive timber land in this vicinity.

THE SURFACE CREEK RESERVOIR, near Delta, Col., gave way on May 15, causing considerable loss to neighboring ranchmen by the destruction of property and the drowning of stock. A dam about 40 ft. high was completely destroyed.

THE CINCINNATI WATER WORKS EXPERTS, Messrs. HERMANY, HORNUNG DE KINDER and ROBINSON, have ended their examinations and are preparing their report. According to press accounts the experts will probably recommend an entirely new plant. The Board of Public Improvements have bought six small pumping engines, of a combined capacity of 17,000,000 galls. in 24 hours for

Elements of Weather in the United States, of Most Interest to Engineers, for the Month of April, 1890.

[Furnished to ENGINEERING NEWS by the Chief Signal Officer, U. S. A.]

STATION	Temperature. (Deg. Fah.) Average.	Max.	Min.	Range.	Wind. Velocity in miles per hour. Average.	Maxim.	Direction at time of max. velocity.	Precipitation.—Rain and melted snow. Inches. Total.	Heaviest in 24 hours.	Number of rainy days.
NORTHERN CITIES.										
Northfield, Vt	39.1	71	17	54	11.1	48	N	1.94	0.57	11
Portland, Me	42.1	70	24	46	9.2	36	NW	2.51	0.87	9
New York City	51.0	81	30	51	11.0	42	NW	2.58	0.61	13
Pittsburg, Pa	52.6	78	28	50	4.5	31	NW	4.87	1.40	14
Chicago, Ill	45.6	75	28	47	20.7	55	SW	3.23	0.90	12
Omaha, Neb	55.1	86	23	63	10.2	36	NW	1.55	1.06	6
St. Paul, Minn	47.8	83	19	64	6.5	27	NW	1.80	0.82	8
Duluth, Minn	40.6	68	17	51	7.0	32	E	1.75	0 69	9
Bismarck, N. Dak	46.8	82	19	63	11.3	50	NW	0.68	0.47	7
Average	46.7	77.1	22.8	54.3	10.2	39.8	.....	2.32	0.82	9.9
SOUTHERN CITIES.										
Washington City	54.0	82	25	57	7.0	36	NW	2.81	0 70	11
Louisville, Ky	58.1	82	34	48	8.7	37	W	3.51	0.89	13
St. Louis, Mo	57.2	89	30	59	13.1	50	S	4.05	1.51	14
Savannah, Ga	66.5	88	46	42	8.3	28	NE	1.09	0.96	3
Leavenworth, Kan	56.6	90	29	61	8.0	36	SW	2.23	0.63	11
Jacksonville, Fla	69.8	88	47	41	8.0	29	SW	0.95	0.53	8
Chattanooga, Tenn	62.4	86	38	48	5.8	29	NW	3.91	1.14	12
New Orleans, La	70.3	84	56	28	9.0	34	NW	3.46	1.86	11
Memphis, Tenn	61.8	83	39	44	8.9	38	S	5.10	1.15	11
Palestine, Tex	66.5	85	46	39	6.0	27	SW	6.96	2.42	12
Average	62.3	85.7	39 0	46 7	8.3	34.4	.....	3 41	1 18	10.6
WESTERN CITIES.										
Helena, Mont	46.0	78	20	58	6.0	30	NW	0.25	0.11	6
Port Angeles, Wash	*	*	*	*	*	*	*	*	*	*
San Francisco, Cal	54.8	81	46	35	9.2	28	W	1.18	0.55	6
Salt Lake City, Utah	50.4	78	29	49	4.7	35	SE	0.94	0.49	7
Denver, Col	47.9	77	20	57	7.4	48	NW	2.50	0.85	9
Yuma, Ariz	71.2	98	46	52	6.6	32	W	†	†	0
Santa Fé, N. Mex	47.6	67	17	50	7.0	36	NW	2.08	1.27	9
Average	53.0	79 8	29.7	50.1	6.8	31.8	.....	1.16	0.51	6 2

* Report not yet received. † Trace.

about $35,000, as a makeshift apparently, and the foundations for these engines are now being prepared. The old engines have been sufficiently tinkered up to give an additional supply of 22,000,000 galls. The pumping capacity of the nine original engines, under the builder's guarantee, was about 86,000,000 galls.; of these engines, one is entirely out of service and the others are sadly in need of repair.

RAILWAYS.

EAST OF CHICAGO.—Existing Roads.

New York, Ontario & Western.—E. Canfield, of Middletown, N. Y., Chief Engineer, writes us as follows concerning the Ontario, Carbondale & Scranton Ry.:

This road, projected in the interest of the New York, Ontario & Western Railway, is being built under three corporate names, the Hancock & Pennsylvania Ry., in New York State, 2.93 miles long; the Forest City & State Line and the Scranton & Forest City Rys., in Pennsylvania, 27.92 miles long and 23.52 miles long respectively. The grading and masonry are completed, and about 35 miles of track have been laid. About 800 men are now at work on the line, and it is expected that the road will be completed and opened for traffic by July. There are three large bridges on the line; one across the west branch of the Delaware River, 895 ft. long and 70 ft. high; the Cadavia Viaduct, 510 ft. long and 70 ft. high; and the Falls Creek Viaduct, 510 ft. long and 60 ft. high. There are also a large number of small bridges. Lathrop & Ellsworth had the contract for the section from Harcock to Forest City, and Dowling & Kennedy for the section from Forest City to Scranton. The Philadelphia Bridge Works had the contract for the bridge work. The construction of the entire line was in charge of Chief Engineer E. Canfield.

Delaware, Lackawanna & Western.—This company is said to be considering an extension from La Salle to Suspension Bridge, N. Y., along Niagara River.

Maine Central.—This company has commenced operating the Upper Coos R. R. and Hereford Ry., recently leased as a part of its system. It is stated that the connecting link between Lunenburg and North Stratford, N. H., 33 miles, will be built at once.

Columbus, Lima & Milwaukee.—Work is progressing favorably between Defiance and Floodwood, O., and about 150 miles additional of the line will be put under contract soon. N. H. Colwell, of Lima, O., is Chief Engineer.

Dutchess County.—Andrews & Warner, of 202 Broadway, New York City, the contractors, are getting their plant in position preparatory to commencing construction at an early date. The road is to run from Poughkeepsie to Hopewell, N. Y., 11 miles.

Toledo & Ohio Central Extension.—This company is constructing an extension from Broadwell to Newton, O., to connect with the Toledo & Ohio Central Ry. Stearns, Hoover & Co., of Columbus, O., have the contract for the line, which is 15 miles long.

Cincinnati, Wabash & Michigan.—The contractors, Oliver Ferguson & Son, have commenced work on the line from Anderson to Rushville, Ind. The road is to be completed by Aug. 15.

Baltimore & Ohio.—A press dispatch says that this company has purchased a tract of land above Georgetown, Md., which it proposes to utilize in securing a southern connection. Plans have already been prepared for a bridge across the Potomac River at this point, and surveys completed from the Virginia terminal of the proposed bridge to Fairfax, Va., on the Virginia Midland R. R. This last road is the property of the Richmond & West Point Terminal Co., which controls the Richmond & Danville, the East Tennessee, Virginia & Georgia and other large railways in the South.

Delaware, Lackawanna & Western.—Work on the extension of the Passaic & Delaware R. R. from Bernardsville to Peapack is being pushed forward rapidly. The line is being made as nearly direct as possible, necessitating considerable heavy cutting.

Philadelphia & Reading.—This company is seeking a more direct outlet for its coal to Buffalo and the north. It proposes, in conjunction with the New York, Lake Erie & Western R. R., to construct a line from Williamsport to Blossburg, Pa., and from this point to Laurenceville, Pa., to run over the Tioga Branch of the New York, Lake Erie & Western R. R. From Laurenceville the New York, Lake Erie & Western R. R. Co. will build a line to a connection with its main line at Erwin, N. Y., 9 miles. This will give the Philadelphia & Reading a short line into Buffalo.

Portland & Rochester.—This company will soon commence the construction of a short line connecting its tracks with those of the Maine Central R. R. in the city of Portland.

Grafton & Upton.—This Massachusetts road has been completed and opened for traffic.

Canadian Pacific.—This company has commenced work on a line from Caughnawaga to Valleyfield, P. Q.

Projects and Surveys.

Rochester, Rensselaer & St. Louis.—C. L. Wait, of Winamac, Ind., resident engineer, writes us as follows:

The surveys have been completed for this road which is projected to run from Rochester, Ind., via Kewanna, Winamac, Francisville, Rensselaer, Indiana and Pilato, to Gilman, Ill., a distance of 100 miles. The route is through a level country affording light work; maximum curve 1.5° and maximum grade 54. There will be bridges across the Tippecanoe and Iroquois rivers 125 ft. and 110 ft. in length respectively. About 80% of the right of way has been obtained, and nearly $150,000 of other local aid obtained. The contract will be let to Chas. A. Benjamin, of Salem, Mass., Sept. 1, 1891. The company was chartered in 1883. John K. Lee, of St. Louis, Mo., is president, and Burr P. Noland, of Winamac, Ind., is chief engineer.

Talbot, Queen Anne's & Kent.—A reconnoissance of this road, which is projected to run from Trappe, Md., to Chestertown, Md., and from Trappe to the Choptank River, is being made by Chas. Goldsborough, of Baltimore, Md.

New York, Bridgeport & Eastern.—The Connecticut Railroad Commission has under consideration the location of this proposed short line between New York and Boston. This company is an outgrowth of the old New York, Boston & Inland R. R. Co., and has secured the right of way of that company. Dr. C. B. Adams, of New Haven, Conn., who was President of the New York, Boston & Inland Co., is one of the promoters of the new scheme and holds some of the stock. In speaking of the project recently he said: "The new company has acquired the right of way of the New York, Boston & Inland Co., and it has capital enough to build the line. The company is sincere in its purpose of constructing and maintaining a parallel road. A good double track road will be built from New York to Boston in as straight a line as possible."

Buffalo, Thousand Islands & Portland.—Incorporated in New York to build a line of railway from a point on the line of the Niagara Falls Branch R. R. to Buffalo, N. Y., with a branch from Niagara Falls village west to the Niagara River. The total length of the road will be 35 miles. Among the incorporators are: Chas. Parsons, W. H. Platt, Jr., Chas. G. Burnham and H. M. Fisher.

New York & New England.—The locating surveys of this road have been completed and the route definitely decided upon. The route is from Troy, N. Y., via Averill Park to the Massachusetts State line.

Pittsburg, Black Diamond & Indiana.—Incorporated in Ohio to build a railway from Wellsborough, W. Va., through central Ohio to the Indiana State line. Among the incorporators are: Col. A. E. Boone, Henry Cassell, W. P. Robinson, and Jas. C. Robe.

Easton & Philadelphia.—Chartered in Pennsylvania to build a line of railway from Easton to New Hope, Pa., a distance of 32 miles. Carroll B. Williams, of Philadelphia, Pa., is President.

SOUTHERN.—Existing Roads.

French Broad Valley.—The contract for the construction of this North Carolina railway has been let to James Raymond, of New York City. The road is projected to run from Asheville, N. C., to the South Carolina State line, with a branch from Mills River to Rutherfordton, N. C., a total length of 100 miles. C. G. Dyott is President, and H. M. Ramseur is Chief Engineer and General Manager; both of 52 Wall St., New York City.

Way Cross Air Line.—J. T. Stone, of Cordele, Ga., writes us as follows concerning the line from Way Cross to Cordele, Ga.:

The road is to run from Way Cross, Ga., via Douglas and Severn, to Cordele, Ga., a distance of 107 miles. About 27 miles of the roadbed have been graded, and 24 miles of the line are completed and in operation. The work is light; maximum grade, 52.8 ft. per mile, and maximum curve, 3°. The route is through a fine timber and farming country, and will, it is expected, have a large traffic in naval stores, lumber, and farm products. About 84 miles of the line have been located, and the surveys for the remainder will be completed in about three weeks. Loring B. Miller, 16 Beaver St., New York City, is President, and L. Johnson, of Way Cross, Ga., is Vice-President and General Manager.

Ohio River.—At a meeting of the directors recently held it was voted to commence the construction of the Ravenswood, Spencer & Glendale R. R. at once.

Decatur, Chesapeake & New Orleans.—It is stated that work will be commenced in about two weeks on this road, between Decatur, Ala., and Shelbyville, Tenn.

Southern & Western Air Line.—This company has filed a mortgage with the Central Trust Co., of New York City, for $1,500,000 of mortgage bonds. It is stated that the bonds have been floated and that the contract for grading the entire line from the end of the present grade at Ward's Gap, 23 miles north of Shelby, N. C., to Cranberry, N. C., has been let to T. D. Dunavant.

East Tennessee, Virginia & Georgia.—Purdy & Retford, of New York City, have the contract for constructing the Johnson City & Carolina R. R., and are preparing to sublet the contract. This road is a branch of the E. T., Va. & Ga., and is projected to run from Johnson City to Embreeville, Tenn. Work is to be commenced at once.

Asheville & Bristol.—The contract for the construction of this road has been let to James Raymond, of New York City, and work is to begin Aug. 1. The road is projected to run from Asheville, N. C., to Bristol, Tenn., a distance of 83 miles. C. G. Dyott is President, and H. M. Ramseur is Chief Engineer; both of 52 Wall St., New York City.

Louisville, New Orleans & Texas.—Track-laying has commenced on the Yazoo branch at Clarksdale, Miss. The line is graded from Clarksdale to Minter City, 40 miles, and the location has been completed from Minter City, to Yazoo City, 65 miles. The contracts have not been let for this section.

South Bound.—Chief Engineer G. D. Wadley has completed the surveys of this road from Savannah, Ga., north 15 miles. He expects to have the line surveyed to the Savannah River in about two weeks. As soon as this is done, and the estimates made, bids will be invited for the construction of the road.

Richmond & West Point Terminal.—At a recent meeting of the directors of this company President John H. Inman's plan for a readjustment of the financial affairs of the company was unanimously approved. The president reported that the floating debt of the company was about $4,800,000, incurred in the acquisition of East Tennessee, Virginia & Georgia and Georgia Central securities. In order to pay this debt and provide $2,100,000 for treasury purposes, Mr. Inman recommended that there be offered to the holders of the common stock of the company the privilege of subscribing for about $5,700,000 of the 5% collateral trust bonds of the company which have been made available under the mortgage by deposit with a trust company of East Tennessee, Virginia & Georgia and Georgia Central securities. It is also proposed to issue about $11,500,000 of additional capital stock of the company, and the president's plan provides that every holder of one hundred shares of common stock of record on June 2 shall be entitled on payment of $1,200 to to receive one $1,000 bond, with current coupon, and twenty shares of common stock. The privilege of subsbribing may be exercised until June 9, 25% to be paid at the outset, and the balance on July 15. After the issue of all the stock contemplated by this plan, the total capital stock of the company will be about $70,000,000.

Charleston, Cincinnati & Chicago.—Work is making very favorable progress on this road. The grading on the division from Johnson City, Tenn., to Minneapolis, Va., 90 miles, has been completed with the exception of 15 miles, and about 14 miles of track have been laid. McDonald, Shea & Co. are the contractors. The section from Johnson City to the North Carolina State line is under construction, and is to be completed Aug. 20. Wm. Kenefick, of Kansas City, Mo., is the contractor. The grading is completed with the exception of one mile on the section from Rutherfordton to Marion, N. C., 25 miles. P. P. Dickinson, of New York City is the contractor. The extension from Blacks to Newberry, S. C., 70 miles, has just been placed under contract, and work has been commenced. Blemtin & Jones are the contractors. From Marion, N. C., to the Tennessee State line, 70 miles, the line has been located, and the location of the extension from Minneapolis, Va., to the Ohio River, 16 miles, has also been completed.

East Tennessee, Virginia & Georgia.—This company has assumed control of the Rome & Decatur R. R., recently purchased, and will hereafter operate it as a portion of its line.

Projects and Surveys.

Thomasville, Silver Valley & Pee Dee.—P. C. Thomas, of Thomasville, N. C., writes as follows:

This road is projected to run from Salem and Winston, N. C., via Thomasville, Denton, Jackson Hill and Milledgeville to Wadesboro or Monroe, N. C., connecting with the Atlantic Coast Line or Seaboard Air Line systems, a distance of 81 miles. The route is through a comparatively level country, affording light work and easy grades and curves. There will be two quite large and about 15 small bridges. The principal business of the road will be in cotton, grain, vegetables, timber and general merchandise. The right of way will be donated and a considerable other local aid in stock subscriptions is expected. Surveys for the road are now in progress. The company was chartered in March, 1889. John J. Cramer is President and C. W. Pearson is Chief Engineer.

Gurley & Point Rock Valley.—F. B. Gurley, of Gurley, Ala., President, writes as follows:

This road is projected to run from Winchester, Tenn., to Gurley, Ala., and thence ultimately to Deposit or Guntersville, Ala., a distance of about 65 miles. The route is nearly directly north and south, passing through a nearly level country, rich in farming lands, timber and minerals. Nearly all of the right of way has been secured, and a considerable other local aid obtained from the towns along the route. The road will probably be built by the English capitalists who are developing the mineral lands along the route. The company was chartered in January, 1890.

New York, Harper's Ferry & Southern.—Incorporated in West Virginia to build a railway from a point on the boundary line between Virginia and West Virginia at or near the Shenandoah river in Jefferson County, along the west side of the Blue Ridge mountains, down the Shenandoah and Potomac rivers to some point east of the Blue Ridge, and thence to Maryland. A branch is to be run from the starting point to Charlestown to connect with the Shenandoah Valley and the Baltimore & Ohio railways. Another branch is to run into Loudoun County to connect with the Washington, Ohio & Western, and another is to pass through the counties of Clarke, Warren, Rappahannock, Culpepper, Madison and Orange to connect with the Chesapeake & Ohio and Virginia Midland at Gordonsville. The incorporators are Colonel R. P. Chew, of Charleston, and other parties from that place and Berryville. The capital stock is $1,000,000. The principal office of the company is to be kept at Charlestown, Va.

Lexington & Richmond.—At a meeting of the stockholders, recently held, the following officers were elected: President, C. J. Bronston; Vice-President, R. S. Bullock; Secretary, Jas. C. Rogers, and Treasurer, R. P. Stall. The road is projected to run from Lexington to Richmond, Ky., a distance of 26 miles, and it is stated that work will begin at once.

Mobile & Mississippi River.—Chartered in Alabama to build a line of railway from Mobile, Ala., northwest to the Mississippi River. Among the incorporators

are: J. G. Thomas, H. Austill, B. C. Willis, of Mobile, and A. J. Phillips, of Camden, Miss.

Oil City.—This company proposes to build a railway from Bowling Green, Ky., to Hodgensville, Ky. A charter is being applied for.

Meridian and Poplar Springs.—It is reported that the contracts have been let for this Mississippi road. J. T. Brouch, of Meridian, Miss., is interested.

Mt. Pleasant, Santee & Little River.—John Runk, of 110 East Bay, Charleston, S. C., Chief Engineer, writes as follows:

This road is projected to run from Charleston, S. C., via Georgetown and through Harry County, S. C., and Brunswick and Columbus Counties, N. C., to Norfolk, Va., a distance of 365 miles. Surveys will be commenced very soon. The work is generally light with easy grades and curves. There will be no bridges exceeding 600 ft. in length except the one across the Chowan River which will be about 1 mile long. The principal business of the road will be in cotton, turpentine, rosin phosphate and lumber. The right of way will be granted. J. C. McNaughton, 228 Dock street, Philadelphia, Pa.

NORTHWEST—Existing Roads.

Chicago, Milwaukee & St. Paul.—This company has just put two parties of engineers in the field to locate the proposed extension from Chamberlain, S. Dak., to and beyond the Black Hills. The first 75 miles of this line is a relocation of the old line surveys which were made nearly 10 years ago into the Sioux Indian Reservation. One party will make the relocating survey and the other will make the preliminary surveys for the further extension to the Black Hills.— A press dispatch states that creditable information is had that this company will not extend its lines west of Chamberlain, So. Dak., this season, although it hopes in a few years to extend the road in that direction.

Northern Pacific.—A press dispatch states that this company will build a branch from Wallbridge, Minn., to a connection with the St. Paul & Duluth R. R., a distance of about 7 miles. The completion of this line will give the company a belt line around the cities of Duluth, West Duluth and West Superior.

Green Bay, Winona & St. Paul—This company has filed a charter for an extension from some point in Brown county to Kewanee, Wis., a distance of 30 miles.

Milwaukee, Lake Shore & Western.—The contracts for the extension from Wausau to Marshfield, Wis., will be let in a short time. The line is to be completed by Aug. 1.

Canadian Pacific.—Work is in progress on the extension of the Qu' Appelle, Long Lake & Saskatchewan R. R., from Saskatoon to Prince Albert.

Projects and Surveys.

New York, St. Louis & Kansas City.—Incorporated in Illinois to build a line of railway from a connection with the New York, Wheeling, St. Louis & Chicago Railway at a point on the Indiana state line to East St. Louis, Ill. Among the incorporators are: J. E. Williams, E. C. Rice, of East St. Louis, Ill.; G. H. Ten Broeck, of St. Louis, and Thos. Cratty, of Chicago.

Quincy, Keokuk, Nauvoo & Ft. Madison.—It is stated that this Illinois road will be constructed this season.

SOUTHWEST.—Existing Roads.

St. Louis & San Francisco.—The annual report of this company for the year ending Dec. 31, 1889, shows the following results from operations as compared with the previous year:

	1889.	1888.
Gross earnings	$5,052,950	$5,573,250
Operating expenses	3,264,683	3,355,614
Net earnings	$2,788,267	$2,417,636

In his statement the general manager says:

"The construction and acquisition of the branch lines during the year 1887 and the first quarter of the year 1888 added about 40 per cent. to the total mileage of the company. This mileage was created in a large and sparsely settled territory, not only to build up the country and secure local traffic to be tributary to our main line, but to obtain through and better connections by different routes to many prominent points Southwest and Northwest. The operation of these roads thus far, taken by themselves, has been unprofitable; but with continued fair crops and the settlement of the country, it is fair to assume they will contribute largely to the revenue of our other lines as well as show better results in their own earnings.

Missouri Pacific.—The Fort Scott & Eastern R. R. has been completed from Fort Scott, Kan., to Rich Hill, Neb. Surveys for the further extension of the road will begin in a few days.

San Antonio & Aransas Pass.—The Waco extension of this Texas road is to be completed by Aug. 1. The engineers have completed the survey for the line from Houston, Tex., to Alexandria, La. Another line will be surveyed.

Projects and Surveys.

Wyandotte County Bridge & Terminal Ry. Co.—Incorporated in Kansas with authority to construct a line of railway through the counties of Johnson and Wyandotte, Kan., and from a point on the Missouri State line in Johnson County, northwest to a point on the Missouri river, near Trinidad, Kan. The length of the road will be about 19 miles. Among the incorporators are: Chas. Lovelace, Jas. D. Husted, Fred. W. Perkins and Chas. A. Peabody.

Sherman, Denison & Dallas.—B. P. McDonald, of Sedalia, Mo., writes as follows:

This road is projected to run from Sherman to Denison and Dallas, Tex. The surveys are now in progress between Sherman and Denison, 10 miles. The route is through a rolling country, affording very easy construction. The right of way and terminal facilities have been secured. The company was chartered March 20, 1890. Contracts will be let in about 30 days. The officers are: C. N. Osburn, Ft. Scott, Kan., President; Geo. M. Jarvis, Sedalia, Mo., Chief Engineer.

Hackett City, Greenwood & Eastern.—R. H. McConnell, of Greenwood, Ark., President, writes us as follows:

This road is projected to run from Hackett City, Ark., via Excelsior and Greenwood, to the boundary line between Sebastian and Franklin Counties, a distance of 20 miles. The route is through a fine farming and mineral country, affording easy grades and curves and light work. J. E. Johnson is Chief Engineer and R. S. Powell is Secretary.

ROCKY MT. AND PACIFIC.—Existing Roads.

Utah Central.—John W. Young, of Salt Lake City, Utah, contractor, writes us that 20 miles of this road have been graded from Salt Lake City west. The road is to run from Salt Lake City west to Great Salt Lake and Grantsdale, a distance of 40 miles. Tracklaying will commence June 1, and it is expected to have the line in operation to Monehassett by July 15. Chas. W. Hardy is the engineer in charge of construction.

Northern Pacific.—This company has awarded the contract for the construction of the company's shops at Tacoma., Wash., to C. McMullen & Co., of Minneapolis, Minn. The shops to be built are: Coach, repair and erecting shop, two stories, 100 × 243; woodworking shop, 90 × 152; engine house and steam heating room, 42 × 74; boiler house, 42 × 76; coal house, shaving and dust tower, 19 × 76; chimney, 150 ft. high; paint shop, 90 × 242; paint shop store house, two stories, 35 × 90; freight repair shop, 90 × 302; two lavatories, 26 × 72: double dry kiln, 40 × 75; machine shop, 120 × 245; engine house for machine shop, 40 × 40; boiler shop, tank shop and copper shop, 80 × 321; blacksmith shop, 80 × 192; coal and iron storehouse, 28 × 150; storehouse for boiler iron, 25 × 50; office and storehouse, 43 × 156; oil house, 43 × 60; round house, first class, 22 stalls; turntable, 65 ft. long; two water tanks, 49,000 galls. each; ash pit, 100 ft. long; sand house, 25 × 42; first class coaling station, 47 × 346; dry lumber shed, 40 × 225. The engine house will be built upon the old location, and the rest upon the new location on the Pacific division. The round house, ash pit, turn table, water tanks and coal house are to be completed by N. v. 1, 1890; the wood-working shop, engine and boiler room and coal room, machine shop and engine room, boiler, tank, tin and copper shop by April 1, 1891, and the remaining buildings by Sept. 1, 1891.

Projects and Surveys.

Dalles, Goldendale & Northern.—Chartered in Oregon to build a railway from The Dalles, Ore., to Goldendale.

Salmon Bay Railway & Development Co.—D. N. Gilman, of Seattle, Wash., President, writes us that this company was organized mainly for harbor improvement in Salmon Bay, near Seattle. No work will be done this year, as the necessary legal authority has not been obtained. The project also includes the construction of a railway from Seattle to the summit of the Cascade Mountains, a distance of 120 miles. R. H. Thomson is Chief Engineer.

Idaho North & South.—J. R. DeLamar, of DeLamar, Idaho, Vice-President, writes us as follows:

This road is to run from Nampa or Cold Well, Idaho, north to the timber belt of the Great Payette lake and thence via Spokane Falls, Wash., to Puget Sound, and south from Nampa via DeLamar and South Mountain to Battle Mountain, Nev., a distance of about 275 miles. The object of the road is to develop the mineral lands along the route. Contracts will be let about August. The officers are: President, J. F. Curtis; Chief Engineer, C. C. Upham, and Secretary, Jas. McGee.

Montana & Western Pacific.—Chartered in Montana to build a railway from Anaconda to Missoula, Mont., and the Idaho Territory line. The principal offices will be at Anaconda, Mont.

Pecos River.—It is announced that the money necessary to build and equip this road has been secured from the sale of bonds. The road is to run from the Texas & Pacific R. R. to Rosewell, N. Mex., along the valley of the Pecos River, 185 miles. H. N. Cloud, of Eddy, N. Mex., is Chief Engineer.

FOREIGN.

Interoceanic.—Work is making very satisfactory progress on the line which will ultimately connect Puebla with the port of Acapulco. This line will be completed as far as Matamoros Izucar by May 20 and construction is in progress between Matamoras and Chietla. Construction trains are now running from Vera Cruz to La Antigua, 22 miles. It is expected that the line will be completed to Vera Cruz by Jan 31, 1891.—The surveys have been completed for the short route from Ayotla to Puebla and estimates are now being made.

Hidalgo.—The line from Pachuca to the City of Mexico will soon be completed. Construction is in progress on the line between Tepa and Tulancingo.

Monterey & Mexican Gulf.—Work is making good progress on the line to Tampico. Construction from Linares south commenced May 1, and the grading has been completed to Victoria. The line is expected to be completed by March, 1891.

Mexican Pacific.—It is stated that 25 miles of this line from Tonala east will be completed by July 1.

Tehuantepec.—About 43 miles of the southern end of this road are completed and in operation, and about 67 miles more have been graded ready for tracklaying. Work on the northern end is also stated to be progressing satisfactorily.

RAPID TRANSIT.

Electric Railways.—The Union Electric St. Ry. Co. is at work on its line between Dover and Great Falls, N. H.

An electric railway is projected at Wilson, N. Y. Mr. David Beers, of New York, is interested.

Sumner T. Dunham and other New York capitalists have been granted a franchise to build an electric railroad between Orange and Athol, Mass. They propose to begin work immediately. The Daft double trolley system will be used, and the company will have the road in running order by July.

The City Ry. Co., of Brooklyn, N. Y., has applied for power to adopt electric traction. It will be tried first on 3d Ave.

The Rochester Ry. Co. has made application in writing to the local authorities of Rochester, N. Y., for the right to construct a street surface, double or single track, railway.

The Citizens' Electric Ry. Co., of Rochester, N. Y., has been formed, with Riley V. Miller, President; Michael Whelan, Vice-President; T. D. Brewster, Secretary, and Charles Johonnot, Treasurer. The proposed route will extend from the junction of Colvin and Mulberry Sts. and along Mulberry to the central portion of the city, to form a connection with the Third Ward electric railway.

The Rapid Transit St. Ry. Co., of Newark, N. J., has awarded a contract to the Sprague Co. for the electrical equipment of the road.

The Essex Passenger Ry. Co. has made application to the Township Committee for a franchise for two new lines. The first is to run from Fifth Ave., Newark, to the West Orange line through East Orange and Orange, along Park Ave., and the second is to be a spur of the first and is to branch off from the main line at Washington St. and run through North Park St. to Montclair. The application covers the right to run the road by the overhead electric system.

The Union Passenger Ry. Co., of Chester, Pa., has awarded a contract to the Equitable Electric Construction Co., of Philadelphia, for its new road. The road will start with five 30-H. P. cars. A Wetherill-Corliss engine will drive the generators. The track will be laid with the Johnson girder rail.

The North Ave. Electric Ry. Co., of Baltimore, Md., is experimenting with an electric car.

The Metropolitan St. Ry. Co. has been organized to build an electric line at Macon, Ga. President, E. G. Harris; Secretary, Theodore Ellis; Manager, J. T. Voss.

The Hamilton (O.) Electric St. Ry. Co. has declined to adopt the storage system of propelling its cars, and has asked Council to grant permission to use the overhead wire system.

The Ann Arbor St. Ry. Co., of Ann Arbor, Mich., will have its Sprague electric in operation by September.

H. D. Sexton and Paul Abt have been granted the franchise for an electric street railway through the city of East St. Louis, Ill.

The Bloomington & Normal St. Ry. Co., of Bloomington, Ill., which has about 10 miles of track, will be operated by electricity. The first car has been put in operation on West Washington Street. The system is the Daft. Extensions are to be built.

The Calumet Electric St. Ry. Co., of Chicago, has been incorporated. This railway is to be constructed from a point in Chicago to the boundary line between Illinois and Indiana. Capital stock, $50,000. Nathaniel Fairbank, Joel D. Harvey, William V. Jacobs, Otho S. Gaither, and Samuel E. Gross, all of Chicago.

The street railway at Atchison, Kan., has been sold for $113,000 to H. J. Ranson, of Des Moines, representing Boston people. It will be converted into an electric line, the Sprague system to be used. John Weber, of Des Moines, and W. L. Challiss, of Atchison, will each have an eighth interest in the company. Challiss sold the line to Weber in November last for $80,000.

At a meeting of the City Council of La Grande, Ore., the electric street railway franchise was amended to grant to R. W. Purdom, as trustees for Messrs. Shurtz and Tobin, an exclusive franchise for 30 years, work to commence on or before June 10, 1890, and some part of the road to be in operation prior to Nov. 15, 1890. The road is to extend from Oro Dell to the old town, through the principal streets of the new town. It is reported that the Oro Dell water power, in the Grand Ronde River, is to be used to furnish the power.

The street railway company at St. John, N. B., has been granted permission to operate its line by electricity, using an overhead wire system.

Elevated Railways.—The Massachusetts Legislature is expected to grant franchises to the West End Co. and the Meigs Elevated Ry. Co.

At Newark, N. J., an elevated road on Market St. is projected.

At Chicago, Ill., a project is on foot to build a line to connect the Lake St. and the South Side elevated roads.

The columns of the elevated railway at Sioux City, Ia

are 18 ft. apart, and the bents are 40 ft. apart. The road-bed is 22 ft. above the street. Electric storage battery cars may be used.

At Denver, Col., it is proposed to bring the Lookout Mountain Resort Ry., into the city by an elevated road.

Street Railways.—Surveys for a line between Roanoke and Salem, Va., are being made by Mr. J. H. Wingate.

A street railway franchise has been granted at Basic City, Va.

The Charleston St. Ry. Co., of Charleston, W. Va., has awarded a contract for ties and timber to S. D. Cox.

A company has been organized at Johnson City, Tenn., to build street railway lines to Jonesboro, Embreville, Erwin and Elizabethton. The incorporators are H. W. Hargreaves, Sam P. Ivins, T. F. Singister, H. G. Chandler and Jo. J. Ivins. Surveyors are in the field.

At Ashville, N. C., a street railway is to be built to Pearson's bridge over the French Broad River, at a cost of $150,000. Another line, 8 miles long, to cost $100,000, is projected.

The East & West Ry. Co. has been organized at Pittsburg, Kan. Capital stock, $20,000.

A contract to build four miles of street railway at Staunton, Va., has been awarded to R. D. Apperson, of Little Rock, Ark., who, until the recent sale to the Capital St. Ry. Co., was the Superintendent of the Little Rock St. Ry. The franchise to build the street railway at Staunton has been granted by the local government there to a company composed of Sam B. Adams and Dean Adams, of Little Rock; E. K. Sibley, H. H. Parmley and A. S. Spotts, of New York. Work has been commenced.

A street railway company has been organized at Roseburg, Ore., by J. R. N. Bell, W. S. Hamilton, T. R. Sheridan, J. C Fullerton and G. A. Taylor, of Roseburg, and Dr. Harry Lane, of Salem. The city franchise will be granted and work will probably begin at once.

HIGHWAYS.

Massachusetts.—The committee on roads and bridges has reported a bill to provide for a commissioner of roads and bridges, to be appointed by the Governor and Council before July 1, 1890, and to serve for three years at a salary of $3,000, besides expenses, with an office in the State-House or some other suitable place in Boston.

Kentucky.—A road is to be built from Covington to West Covington and Ludlow. The grade is not to exceed 5 per cent., so that considerable grading and filling will be required. The work will be under the control of three commissioners, one for each city; the cost will be $24,000, of which each city will pay $8,000.

Maryland.—The Road Commissioners or Supervisors of Baltimore County have determined to form a permanent association, having in view the better improvement of the roads by conferring together and comparing notes. W. S. Cowley was elected President, and Mr. Felter, Secretary. The Supervisors agreed upon a system for advertising for proposals for repairing roads, and submitted it to the County Commissioners for their approval.

New Hampshire.—At the special town meeting at South Alsted recently the selectmen were instructed to borrow $3,500 to build the Thurston road. They have been trying to get the road for several years.

Illinois.—It has been voted by the citizens of Centerville Station Township, to build rock roads from East St. Louis to Caseyville, to Collinsville, to Centerville Station and to Cahokia, in all 16 miles, and the issue of $59,000 in bonds for said purpose has been authorized. The Highway Commissioners of that township held a meeting at their office in New Brighton recently, at which the plans and specifications for the construction of said roads were arranged; and it was ordered to advertise for bids for constructing said roads.

At the recent monthly meeting of the Road Superintendents of Duval Co., at Jacksonville, estimates and surveys of proposed road from South Jacksonville ferry to Phillips' Station was shown by Superintendent Brown, prepared by himself, and he was instructed to prepare plans and specifications and advertise for bids to grade said road. Superintendents Dillon and Brown were appointed a special committee to confer with some attorney with a view to preparing some general specifications for road work by districts, the form of advertisement for bids, and bond for faithful performance of contract.

WATER-WORKS.

NEW ENGLAND.

Veazie, Me.—We have received the following information from A. J. McPhetres, Chairman of the Selectmen:

The Penobscot Water Co. is doing all the work in connection with the new plant. President, F. H. Clergue, Bangor, Me. Water will be pumped to a stand-pipe. For further information addre s Laughton & Clergue, Bangor, Me. The works are to be completed in December.

Portsmouth, N. H.—The city is considering the question of purchasing the Aqueduct Co.'s works.

Hinsdale, N. H.—Mains are to be laid in Bragne St.

Reading, Mass.—The citizens have cast a two-thirds vote in favor of issuing $150,000 of bonds for constructing works, and authorized the Water Commissioners to enter into a contract.

Foxboro, Mass.—The water supply project has been defeated by a citizens' vote.

Somerville, Mass.—The Water Commissioners have applied for an appropriation of $25,000 for improving the water service.

Jamestown, R. I.—Councilmen G. C. Carr, Daniel Watson and Elijah Anthony have been appointed committeemen to negotiate with and contract for the establishment of a system of works. The terms of the proposed contract call for 20 hydrants, at an annual rental of $30 each for a term of 30 years.

West Brookfield, Mass.—A small reservoir is being built by the aqueduct company.

MIDDLE.

Amsterdam, N. Y.—The water commissioners are considering the feasibility of constructing a pipe line from the terminus of the Hans Creek conduit to the distributing reservoir.

Syracuse, N. Y.—The Common Council, on the application of the Water Commissioners, has voted the sale of $500,000 of bonds. Preliminary steps will soon be taken toward bringing Skaneateles Lake water to the city.

Rochester, N. Y.—It is now proposed to supplement the water supply by repairing and putting into use an abandoned artesian well, located on the farm of P. J. J. Ermise. A small pumping engine is to be purchased and erected in a new pumping station. Chief Engineer J. Nelson Tubbs estimates the cost of the machinery at $6,000, and for laying a new main to connect with the Chili Ave. main at $4,000.

Mohawk, N. Y.—Civil Engineer E. Delevan Smalley, of Canastota, N. Y., has sent us the following information:

Contracts for building the works will be let in the latter part of June. Work is to be commenced in July and completed by Nov. 1. The supply will be taken either from surface water or an excavated well, and pumped into a stand-pipe, 16 ft. in diameter by 150 ft. high. About 40 hydrants will be set. The estimated cost is $20,000 to $30,000, to be procured by town bonds. Valentine Brown is chairman of the water board. Population, 2,000.

Camden, N. J.—A bill has passed the House repealing the act authorizing the city to issue $1,000,000 of bonds.

Allegheny, Pa.—Engineer Swan has presented a map showing the route surveyed for the new pipe line from a point at the head of Nine-Mile Island to William street, in the city. A report has also been made by Superintendent Edwin Armstrong estimating the total cost of the contemplated improvements at $1,369,559, exclusive of filters. The work on the latter estimate includes the furnishing and laying of the 60-in. iron or steel main, to be ⅛ in. thick, double riveted, and to stand a pressure of 100 lbs. to the in.; removal of the old pumps from the present pumping station to Nine-Mile Island, and the purchase of a new pump with a capacity of about 8,000,000 galls. per day; also the riprapping and dredging necessary in the river, 10 per cent for incidentals. Superintendent Armstrong has been instructed to correspond with consulting engineers, Engineer Swan was instructed to make specifications so that bids can be called for, and Mr. Cochran was instructed to employ an architect to make specifications, etc., for a new pumping station

Washington, D. C.—The District Commissioners have made an order authorizing a special water service to carry a supply of water to Tunlaw Heights. The work is to be done at the expense of the trustees of Tunlaw Heights, and the water delivered by meter, and paid for at three cents per thousand galls.

Cumberland, Md.—Bonds for $75,000 are now being offered for sale. Address L. M. Shepherd or C. L. Holzihu, Trustees of the Sinking Fund.

SOUTHERN.

Warrenton, Va.—A contract has been awarded for the construction of works, to be completed within 90 days. Address C. W. Rosenberger.

Anderson, S. C.—Work is progressing rapidly. The foundation for the stand-pipe has been completed, and work on the engine house has been commenced. Two reservoirs of 1,000,000 galls. and 250,000 galls., respectively, are being constructed. The stand-pipe will have a capacity of 200,000 galls.

Charleston, S. C.—Aldermen McGarey, Johnson, O'Neill, Schachte, Webb and Darby have been appointed a committee to report at the next regular meeting of the City Council on the question of purchasing the water company's plant at the expiration of the present contract, which expires on Jan. 19, 1891.

Eatonton, Ga.—B. D. Lumsden, of Macon, Ga., has purchased land upon which to build a reservoir. He proposes to supply the town with water.

Cordele, Ga.—Capt. J. W. Wilcox, of Macon, Ga., has been awarded the contract for putting in a system of works. The contract calls for their completion within six months.

Atlanta, Ga.—It is reported that the $250,000 of improvement bonds will be issued notwithstanding the statement made by the city attorneys and mayor that their validity is doubtful if issued by the authority granted by the recent special election.

Bridgeport, Ala.—D. Giles, of Chattanooga, Tenn., has been awarded the contract for building the new works. Water will be taken from springs, 3 miles distant, and 300 ft. above the town. Mains will be laid through all the principal streets, and 60 fire hydrants will be set.

Nashville, Tenn.—The Board of Public Works and affairs has awarded the contract for the intake pipe at the upper island as follows:

Jackson & Philbin (composed of H. S. Jackson & Co., of Nashville, and Mr. Philbin, of St. Louis), to lay the pipe in the river and make the excavation at $18,300.

Whitsett & Adams, of Nashville, for building the crib, at $9,147.

The Addyston Pipe & Steel Co., of Cincinnati, furnishing the pipe and special castings at $26 per ton.

The Galvin Brass & Iron Works, of Detroit, Mich., for furnishing one 48-in. and five 36-in. valves, at $2,550.

North and West Knoxville, Tenn.—Surveys are being made by the Woltmann Water-Works Co., and work will soon be commenced. The water committee, B. F. Young, M. D., Chairman, has recommended that the supply be taken from Tillery Creek and adjacent springs.

Ashland, Ky.—The Ashland Water Supply Co. invites proposals for erecting water-works to supply a growing city of 7,000 inhabitants, containing large manufacturing establishments and 27 miles streets.

Somerset, Ky.—Proposals will be received until June 1 for the construction and operation of a system of works and for supplying the town with 55 hydrants, etc. Address, A. L. Parsons, Chairman Water Committee.

Richmond, Ky.—A company composed of Messrs. Woodbury, Moulton and Boardman, has purchased the gas works of the city, and the water and electric light franchises, and will improve the gas work and build water and electric light works. The city has contracted to pay the consolidated company $3,000 per year for water supply and the same for furnishing gas. Construction is to be begun within 90 days.

NORTH CENTRAL.

Carthage, O.—Bids for $20,000, of bonds, bearing 5 per cent. interest, will be received until June 19, by Elmer E. Ross, Village Clerk.

Huntington, Ind.—A system of works is to be established this season by a local company under a franchise. Cost, $100,000. John W. Hill, of Cincinnati, O., has been engaged to prepare plans and specifications and superintend their construction.

Owosso, Mich.—The city has awarded a contract to W. R. Coats, of Kalamazoo, Mich., to put down one of his reservoir wells, and to further develop the water supply. The system of securing the supply from driven wells has proved a failure.

Bay City, Mich.—The Common Council has ordered new mains to be laid to the south end of the city.

Chicago, Ill.—(Regarding Lake View, recently annexed to Chicago). Mayor Cregier, with other city officials, has made an inspection of the Lake View works. At the suggestion of City Engineer Northway it was decided to use 1,100 ft. of 30-in. water-pipe, not now in use at Hyde Park, for an extension of the suction pipe in the lake.

Belleville, Ill.—The works located at North Belleville will be sold by Madison T. Stookey, Receiver of the City Water Co., together will all property and franchises belonging to the City Water Co., on Monday, June 23, at the court house in this city to satisfy a decree of the United States Circuit Court for the Southern District of Illinois in favor of the American Loan and Trust Co., of New York, which held $150,000 of the first mortgage bones of the City Water Co. The works have been in operation since October, 1885.

Carlinville, Ill.—Engineer F. Wm. Raeder, of St. Louis, Mo., has sent us the following:

A certificate of a satisfactory test of the new works has been issued to the water company by the City Council. The city pays a yearly hydrant rental of $3,000. The supply is taken from Macoupin Creek. President and Treasurer, W. G. Reeve, of Peru, Ill; Engineer and Secretary, F. Wm. Raeder, of St. Louis, Mo.; Superintendent, George Siegel.

Shell Lake, Wis.—A unanimous vote has been taken in favor of loaning $10,000 for putting in works.

Dowagiac, Mich.—James Mann, Superintendent of the city works, informs us that they propose putting long strainers on the bottom of the artesian wells this season.

Oshkosh, Wis.—The works have been sold to a syndicate of Eastern capitalists. W. Maxcey has been elected President of the new company. Improvements will be commenced at once.

NORTHWESTERN.

Wilton, Ia.—A vote will be taken on May 26 on the question of issuing $6,000 of bonds for establishing works.

Le Mars, Ia.—J. H. Winchell has purchased the entire plant and franchises from the water and light company at $45,000.

West Superior, Minn.—J. F. Ward & Co., of New York, have been awarded the contract by the Superior Water, Light & Power Co., to extend the 24-in. intake pipe for the city water supply to Lake Superior, a distance of 18,000 ft. Work will be commenced at once. The estimated cost of the extension is $200,000.

St. Paul, Minn.—Bids will be received until June 2 for $100,000 of bonds bearing 4% interest, running thirty years, by John W. Roche, City Comptroller.

Lincoln, Neb.—C. L. Goodhue, of the firm of Goodhue & Birnie, of Springfield, Mass., has offered the city $200,000 in cash for its works, and promised to make improvements immediately costing $250,000. The offer was refused.

Fargo, No. Dak.—Engineer Wheeler is preparing plans and specifications for a new system of works.

Whitewood, So. Dak.—A new 50,000-gall. reservoir is to be constructed. It will be located 130 ft above the town.

Helena, Mont.—George F. Woolston is preparing to make extensive improvements to the consolidated company's plant.

Livingstone, Mont.—City Clerk W. D. Kelly has sent us the following:

The new works constructed by the Livingstone Water-Works Co. will be completed about May 25. Cost, about $40,000. Water is pumped from the Yellowstone River to a reservoir, having an elevation of 140 ft. above the city. Samuel Burdock was the engineer of the works. Population, 3,000.

SOUTHWESTERN

Carthage, Mo.—The Carthage Water-Works Co. has filed a statement of the increase of its capital stock from $150,000 to $200,000.

Brinkley, Ark.—The Brinkley Water-Works, Electric Light & Power Co. has been incorporated. President, W. S. McCullough; Secretary, T. H. Jackson. The capital stock is $25,000.

Cuero, Tex.—Guido Jaeger, of Rich Hill, Mo., con. tractor for the new works, informs us that the works have just been completed. Two compound duplex 500,000 gall. Smith & Valle pumps pump water from the Guadaloupe River direct to the mains and to astand-pipe 16 ft. in diam. by 110 ft. high. Engineer, W. R. Freeman, of San Antonio, Tex. The works are owned by the city. Cost, $36,500.

Denver, Col.—The Mountain Water Co. is about to reorganize and increase its capital stock from $100,000 to $500,000 for the purpose of building a gravity system of works. The company now has a plant in operation. Further information can be obtained by addressing the company.

Denver, Col.—A contract has been closed with the Denver Water Co. by the Strayer Investment Co., by which the former is to run a 12-in. main through Strayer's Park Place, Watertown Place, Strayer's Park View, Oakland, Linwood and the new townsite on the Union Pacific R. R., to be known as East Denver. The same rates are to be charged and the same service given as in the city. Plans for two reservoirs near Palmer Lake have been filed with the State Engineer, J. P. Maxwell. They are to supply two ditches, one for Palmer Lake and the other for North Palmer Lake. These reservoirs are to be located at the head of Cook Creek and will cover 500 acres.

PACIFIC.

Colville, Wash.—The Spring Mountain Water Co. has been incorporated, with a capital stock of $50,000. The trustees are: J. M. Buckley, E. J. Roberts, John B. Slater, Samuel Douglass and J. H. Young.

Walla Walla, Wash.—The company has offered to sell its plant to the city for $200,000.——The City Council has passed an ordinance to establish works. The question will be voted upon at the July election.

Corvallis, Ore.—The Corvallis Water Co has ordered through John Barrett, Portland agent for the Worthington steam pumps, a new double-acting Worthington pump of 1,271,700 galls. daily capacity.

Enterprise, Ore.—A number of citizens have formed a company for the purpose of constructing a system of works. A pump with a daily capacity of 500,000 galls., will be placed at the flouring mills, and the water will be forced to a reservoir on a hill just east of town.

Tillamook, Ore.—The Tillamook Water Co. nas been incorporated with a capital stock of $50,000. Its object is to construct works. The incorporators are: Van B. De Lashmutt, Claude Thayer and G. V. Nolan.

Portland, Ore.—Sealed proposals will be received until June 3 for the purchase of $50,000 of the bonds in denominations of $1,000 each, payable in 1917, and bearing 5 per cent. interest, payable semi-annually. Address Frank T. Dodge, Clerk.

Los Angeles, Cal.—F. M. French, contractor for laying three miles of 44 in. pipe, has commenced work. The water company also has a force of men at work upon the brick tunnel, to be one-half mile long. Extensive improvements are to be made.

San Bernardino, Cal.—The following bids have been received for laying the pipe for the new works:

George M. Cooley and Edward Daley, Sr., 12-in., 27.43 cts.; 10-in., 23.8 cts.; 8-in., 19.7 cts.; 6-in., 16.7 cts.; 4-in., 12.5 cts.; 3-in., 12.5 cts. Extra excavating, 40 cts. per cu. yd.

Fred Osborne, of San Diego, total bid, 15½ cts. per lin. ft.; extra excavating, 15 cts. per cu. yd.

Winsby & Elliott, of San Diego, total bid, 12.8 cts. per lin. ft.; extra excavating, 11 cts. per cu. yd.

E. F. Phelan, of Los Angelos, 12-in., 26 cts. per ft.; 10-in., 23 cts.; 8-in., 20 cts.; 6-in., 17 cts.; 4-in., 15 cts.; 3-in., 12 cts.; extra excavating, 27 cts. per cu. yd.

Frank Walker, of Los Angelos, 12-in., 23 cts. per ft.; 10-in., 21 cts.; 8-in., 20 cts.; 6-in., 19 cts.; 4-in., 17 cts.; 3-in., 16½ cts.; extra excavating, 20 cts. per cu. yd.

T. R. Griffith, of San Bernardino, 12-in., 24 cts. per ft.; 10-in., 21 cts.; 8 in., 18 cts.; 6-in., 13½ cts.; 4-in., 12 cts.; 3-in., 10 cts.; extra excavating, 30 cts. per cu. yd.

M. McDonald, of San Bernardino, 12-in., 26 cts. per ft.; 10-in., 24 cts.; 8-in., 21 cts.; 6-in., 20 cts.; 4-in., 18 cts.; 3-in., 16 cts.; ex ra excavating, 60 cts per cu. ft.

The contract was awarded to T. R. Griffith.

Tooele City, Utah.—Francis M. Lyman, Box B, Salt Lake City, has sent us the following:

The construction of the new works has been commenced. They are to be comple'ed about July 4. All the contracts have been let. Water is conveyed by gravity from a spring to a tank. Estimated cost, $15,000. There will be 5 miles of pipe, 2½ to 8 ins. in diameter, furnished by the Puget Sound Wooden Pipe Works. The officers of the Tooele City Water Co. are: President, Francis M. Lyman; Vice-President, Alexander Herron; Secretary and Engineer in charge of surveys, Francis M. Lyman, Jr.; Designing and Constructing Engineer, David James, of Salt Lake City.

Boise City, Idaho.—It is reported that Eastman Bros. have secured a large flow of water from an artesian well, located on the foothills of the Kensington addition.

CANADA.

Chatham, Ont.—Excavation for the stand-pipe has been commenced. The supply well will be 38 ft. in diameter by 60 ft. deep.

Napannee, Ont.—Hinds & Bond, of Watertown, N. Y., contractors, inform us that the new works will be completed about June. Valves, Eddy; hydrants, Holyoke.

Calgary, N. W. Ter.—Work will be commenced early in June. Four miles of pipe will be laid. Estimated cost, $65,000. Contracts have already been made for two pumping engines with a daily capacity of 1,500,000 galls. Mr. Alexander is a member of the company.

FOREIGN.

Mazatlan, Mex.—The new water supply is conveyed from the Presidio River, through 20 miles of steel mains. The cost of putting in the plant was $500,000, furnished by Spanish capitalists.

Hong Kong, China.—The draft for a bill to provide for the levying of a water rate to defray the cost of the waterworks, and for measuring water by meters is being considered by the Sanitary Board.

PROJECTS.

Pell City, Ala.; Pell City Iron & Land Co.—Flandrean, So. Dak.—Falls of Rough, Ky.; Falls of Rough Water Co —Yazoo City, Miss.—Deptford, Minn.; Deptford Land & Improvement Co.—Walthourville, Ga.; C. B. Warraud.—Watertown, Wis.—Flint, Mass.—Tipton, Ind.—Bentonville, Ark., W. D. Mauch, Mayor.—Marysville, O.; L. G. English.—Laurens, S. C.—Cape Girardeau, Mo.—Sheffield, Ala.; H. F. Jones, Town Clerk.

ARTESIAN WELLS.

Stout, Col.—A flow of 80 galls. per hour is being secured from a well at a depth of about 1,200 ft.

IRRIGATION.

Bakersfield, Cal.—The Kern & Tulare Irrigation District has been organized and officers have been elected.

Pueblo, Col.—Articles of incorporation of the Lake Canal Co. have been filed. The incorporators are: O. H. P. Baxter, H. R. Holbrook and Robert Gibson.

The object of the company is to construct and operate a ditch from a point on the Arkansas River, in Section 19, Township 22 south, Range 57 west, running thence in a general southeasterly direction on the north side of the Arkansas. Capital stock, $300,000. The directors for the first year are: O. H. P. Baxter, Charles Henkel, James B. Orman, Robert Gibson, and Henry R. Holbrook. The principal office of the company will be located in Pueblo, but its business will also be transacted in Bent and Otero Counties.

Glenwood Springs, Col.—The Grass Valley Land, Loan and Irrigating Co. has been incorporated to operate in Garfield County. The capital stock is $100,000.

Tulare, Cal.—We have received the following information:

P. J. Flynn, C. E. of Los Angeles, Cal., has completed estimates and reported on the projected irrigation works for this district. The estimate for the line selected is $659,000. The works include head-works on the left bank of the Kaweah River, and 34 miles of main canal, having a capacity of 500 cu. ft. per second. This line includes two tunnels of 700 and 1,100 lin. ft., respectively. About 5 miles of the work is on side-hill ground with slopes of from 1 to 30°. There is also a reservoir having a storage capacity of 635,000,000 cu. ft. The dam is of earth 3,800 ft. long by 56 ft. high. The reservoir is chiefly intended for storage for very dry years when a supply for irrigation is not available from the Kaweah River.

Lostine, Ore.—The office of the Middle Valley Irrigation & Water Ditch Co. is at this place, instead of Salem, Ore., as noted in our issue of May 17.

Colusa, Cal.—Eli Morton has been elected President, and J. W. Goad, Secretary, of the Colusa Irrigation District.

SEWERAGE AND MUNICIPAL.

Sewerage.—A bill has been passed authorizing the construction of a system of sewerage at Hornellsville, N.Y.

Mr. Joseph B. Rider, engineer in charge of the sewerage work at White Plains N. Y., has recommended the expenditure of an additional amount of $15,700 for lowering the entire outlet pipe and disposal works 3 ft. The grades from Lake St. across the swamp land, to the proposed pumping station, are 2 to 4 ft. out, necessitating extra work.

A meeting of the common council of Orange, N. J., was held recently to receive the report of C. Ph. Bassett, of Newark, the engineer who has been employed to prepare the preliminary plans for a system of sewerage for the city. The plan is as follows: To construct sewers in 30 of the 47 miles of streets in the city and to carry the sewage to tidewater. The sewage from the whole city will be carried by gravity, except from that portion known as the Valley. This comprises only 285 acres out of the 1,400 acres in the entire city. For this portion of the city it is proposed to establish a pumping-station that will pump the sewage to a high level, from which it will join the gravity system. The sewage is to be carried by a trunk connection through the townships of East Orange, Bloomfield and Belleville to the Passaic River, along the route of the Second River. At the Passaic there will be a tidal chamber constructed for the collection of the sewage, sufficiently large to hold 12 hours' output, and its contents will be discharged on the full tide as soon as it begins to ebb. By this means all possible danger of contaminating the water supply of Newark and Jersey City, which is taken from the Passaic 2 miles above the point, will be prevented. The estimated cost of the work is as follows: Thirty miles of street sewers and the necessary mains, $228,334.89; Passaic River outlet, including the tidal chamber, $105,838.70; total, $334,173.59. In addition to this there is a plan submitted for the drainage of the city and the carrying off of the storm water, at an estimated cost of $149,495.

At Philadelphia, Pa., an ordinance has been passed to authorize the Board of Public Works to expend a certain sum for the construction of a well and other apparatus for the purpose of flushing the sewers.

At Cincinnati, O., the following changes in the Lick Run sewer contract with M. Peter & Sons have been recommended by Assistant Engineer Boch: First—To dispense with the vitrified brick inlet laid in Portland cement in the sewer 9, 13 and 14 ft. in diam., and substitute therefor the ordinary sewer or paving brick laid in natural cement, excepting for a width of 4 ft. in the bottom, where a single ring of vitrified brick is to be laid in Portland cement. Second—To omit the vitrified brick invert in sewers 3, 4 and 5 ft. in diam., and substitute therefor the ordinary brick laid in natural cement, the bottom, for a width of 4 ft., to be covered with a mortar 1½ ins. thick, composed of 1 Portland cement and 2 clean, sharp sand. These changes reduce the cost of the sewers and will not impair the efficiency, durability or strength.

The city engineer of Denver, Col., has sent to the board a model of the O'Brien sewer receiver. It has a basin and double trap. The size of the body is 22 ins. square, with upright box 5 ft. in diameter, outlet 10 ins. The weight is 750 lbs. Length of trap, 26 ins., coal tarred inside and out.

The cost of a trunk sewer at London, Ont., has been estimated as follows by the City Engineer:

River to Wellington street, 6 ft. 6 in., 2,660 ft., at $11	$29,260
Wellington to Maitland street, 5 ft. 6 in., 2,650 ft., at $10	26,500
Maitland to Elizabeth street, 5 ft., 2,540 ft., at $9	22,800
English to Egerton street, 4 ft. 6 in., 3,000 ft., at $7	21,000
Egerton to limits, 4 ft., 800 ft., at $5	4,000
English to limits, via Lorne, 12-in. tile, 2,000 ft., at 75c	1,500
	$111,870

Street Work.—The Board of Awards, Pittsburg, Pa., has awarded paving contracts to Booth & Flynn and Sloane & McIlwayne.

At Reading, Pa., an ordinance has been passed providing for improved paving on 5th street and other streets.

The council has been re-elected and will carry on the street improvements already projected.

At Charlotte, N. C., it has been decided to issue bonds for $75,000 for street improvements. For particulars address the mayor,

At Dubuque, Ia., experiments are to be made with various kinds of paving material.

At Salt Lake City, Utah, the Chamber of Commerce has passed a resolution "that the City Council be urgently requested to thoroughly investigate the qualities of Utah products for sidewalk and paving materials, and whenever it is possible to use native products in any public works that they be preferred to products of other sections, as it is well known that there are inexhaustible quantities of superior flagging stone and cement paving materials close to Salt Lake City."

The Roads and Finance Committees, of Montreal, Canada, have decided to lay asphalt, granite and wood paving in the city wards. Estimates have been prepared by the city surveyor.

ELECTRICAL.

Electric Lighting.—The Lowell Electric Light Co., of Lowell, Mass., has awarded contracts for a new building which will cost $21,000. White & Sweatt have the contract for brick work, and E. G. Baker & Co., the contract for iron work.

The Syracuse Electric Light & Power Co., of Syracuse, N. Y., has made a proposition to the Council to furnish 130 additional lights at 38½ cts. per light per night.

At Fredonia, N. Y., it is proposed to establish an electric light plant instead of renewing the contract with the gas company.

The East End Electric Light Co., of Pittsburg, Pa., will put in an extensive plant for the lighting of Glenwood, Hazlewood, Sharpsburg, Wilkinsburg, Homestead and other adjacent towns. An auxiliary station will be located at Sharpsburg.

The Scottdale Electric Light, Heat & Power Co., of Scottdale, Pa., has awarded contracts to the Fort Wayne Co. at $12,791 for plant, and $4,389 for poles and primary and secondary wiring for arc and incandescent systems. There will be two alternating dynamos each for 650 lights of 16-candle power; and an arc plant of 252,000 candle power capacity.

The Albany Improvement Co., of Albany, Ga., has applied for a franchise for electric lighting.

At Goldsboro, N. C., a contract has been awarded to the Goldsboro Electric Light Co. for 4 arc and 80 incandescent lights. The contract price is $1,800 per annum.

The Cincinnati Edison Electric Light Co., of Cincinnati, O., has been formed for the purpose of producing, distri-

buting and selling electric light, heat and power. Capital stock, $1,000,000. The incorporators are Lowe Emerson, J. H. Rhodes, C. M. Holloway, J. Gordon Taylor, Thos. C. Pearce and Thomas G. Smith.

At Tecumseh, Mich., a five years' contract for electric lighting has been awarded to C. C. Travis, of Chicago.

At Sigourney, Ia., the question of establishing electric lights has been carried by a public vote.

The Joplin Electric Light & Power Co., of Joplin, Mo., has been bought out for $55,000, by C. Rusling, of Joplin; E. P. Merwin of New Haven, Conn.; E. L. Martin, A. E. Stilwell and M. C. Curtis, of Kansas City, Mo. The purchase includes the Grand Falls water power. About $100,000 are to be spent on improvements.

The Portable Electric Light & Power Co. has been incorporated at Denver, Col. The board of directors is composed of Henry R. Wolcott, Melvin Edwards, Theodore H. Thomas, Isaac E. Blake, H. B. Chamberlain, C. L. McIntosh and Thornton H. Thomas. The principal office will be located in Denver. The capital stock is $1,500,000. This company has the exclusive control in Colorado, Texas, Wyoming and New Mexico, in which it intends to introduce and utilize the invention of Mr. William Wright, of New York City, in producing electric light and power. By this system electricity is produced without the aid of a dynamo. The invention consists of an electrolyte or compound, and is used in an ordinary battery.

Underground Wires.—The Fire Department, New York City, has awarded the contract for placing fire alarm electrical conductors underground to the Standard Underground Cable Co. at $47,771.59. The specifications include the furnishing and laying of 30,000 ft. of 2-in. pipe and 650,000 ft. of No. 4 conductor in "Standard" lead-covered underground cables, braided and painted with "P. & B." paint. Work will be commenced immediately.

BRIDGES, TUNNELS AND CANALS.

Canal.—*St. John's.*—The St. John's & Sebastian Canal Co. has been incorporated by Norman Robinson, S. R. Robinson, F. R. Webber and others, of Orlando, Fla., to cut a canal 35 miles long in Brevard county. Capital stock, $100,000.

Bear Lake.—The following are the bids received by the Bear Lake & River Water-Works & Irrigation Co., of Ogden, Utah. Mr. Elwood Mead is Chief Engineer. The contract was awarded to Corey Bros., of Ogden:

POINT LOOKOUT CANAL.

Bidders.	For clearing and plowing per acre.	For excavating earth per cu. yd.	For excavating loose rock, per cu. yd.	For excavating solid rock, per cu. yd.	For excavating foundation pits per cu. yd.	For overhaul per 100 ft., per cu. yd.
	$	Cts.	Cts.	Cts.	Cts.	Cts.
Corey Bros., Ogden	5.00	7¾	30	70	.....	1
Wade & Jones, Ogden	8.00	9.45	32	95, 79	.....	0.95
Crisman & Weiler, Salt Lake City	12.00	9¾	38	80	15	1½
Carroll & Donoghue, Ogden	14.00	10	30	70	.....	1
Wm. Garland, Ogden	.....	12¼	35	75	.....	1
Stafford & Co., Denver, Col	2.50	7 9-10	25	75	15	½
Annett & Thompson, Collinston, Utah	12.00	10½	35	80	20	1
Kilpatrick Bros. & Collins, Beatrice, Neb.	12.00	9¾	45	95	18	¼
R. A. Graham, San Diego, Cal	.....	9	.....	.....	.....	.....
Keating Bros. & Co., Pittsburg, Pa	.....	7¾	27	59	.....	.....

CORINNE LATERAL CANAL.

Bidders.	For clearing and plowing per acre.	For excavating earth, per cu. yd.	For excavating loose rock, per cu. yd.	For excavating solid rock, per cu. yd.	For excavating foundation pits per cu. yd.	For overhaul per 100 ft., per cu. yd.
	$	Cts.	Cts.	Cts.	Cts.	Cts.
England Bros., Plain City, Utah	8.00	10	40	80	20	¼
Corey Bros., Ogden, Utah	5.00	7¾	30	70	.....	1
Wade & Jones, Ogden, Utah	8.00	10.35	29	09	.....	1
Crisman & Weiler, Salt Lake, Utah	12.00	9¾	35	75	15	1½
Carroll & Donoghue, Ogden, Utah	14.00	9	30	70	.....	1
Wm. Garland, Ogden, Utah	.....	12¼	25	75	.....	1
Stafford & Co., Denver, Col	2.50	7 9-10	25	75	15	½
Annett & Thompson, Collinston, Utah	12.00	9½	35	80	20	1
Kilpatrick Bros. & Collins, Beatrice, Neb.	12.00	9¾	45	95	18	¼
R. A. Graham, San Diego, Cal	.....	9	.....	.....	.....	.....
Keating Bros. & Co., Pittsburg, Pa	.....	7¾	27	59	.....	.....

Bridges.—*Northampton, Mass.*—Two iron bridges to cost $46,200 will be built at this place.

Shelburn Falls, Mass.—The iron bridge across the Deerfield River at this place will cost $18,000. The specifications are nearly completed, and bids for construction will soon be asked for.

Waterford, Vt.—The toll bridges across the Connecticut River at Upper Waterford and Lower Waterford, Vt., recently carried away by high water, will be rebuilt.

Elizabeth, Pa.—The officers of the Elizabeth Bridge Co., before mentioned, are: President, B. L. Wood, Jr.; Secretary, Geo. W. Theis; Chief Engineer, S. C. Weiskopf. The company propose to build a bridge across the Monongahela River at this place. The bridge will be built during the coming summer.

Harrisburg, Pa.—This company has awarded the contract for the large bridge over the Susquehanna at Harrisburg. The bridge will have 23 spans besides approaches, and will be 4,500 ft. long. Cofrode & Saylor, of Pottstown, have the contract to construct the bridge, but the Rolling Mill Co. will do a large part of the work. An extended elevated structure will connect the Lebanon Valley R. R. at Harrisburg with the bridge, and the contract for this was awarded to the Phœnix Iron Co., of Phœnixville. The cost of the entire work is over $300,000.

Columbus, O.—Proposals will be received until June 13 for the construction of a combination steel and iron bridge over the Scioto River at Mound St., Columbus, Ohio. Further details will be found in our proposals open column.

Wheeling, W. Va.—F. O. Hodge and W. C. Smith have been appointed to draw plans for the Main St. bridge at this place. The structure will cost about $92,000.

Wheeling, W. Va.—G. P. Bissell, J. B. Thomas, of Boston, Mass.; H. E. Russell, of New York City, and others have incorporated the Wheeling & Eastern Improvement Co., to build a bridge across the Ohio River. The capital stock is $600,000.

Birmingham, Ala.—The contract of the city with the Smith Bridge Co., of Toledo, O., for the building of the Twenty-first St. bridge, to cost $29,000, has been annulled, and bids will again be advertised for.

Pineville, Ky.—Bids will be received until May 30 for the construction of a combination wood and iron bridge. L. S. Fitzhugh, Pineville, Ky.

Douglas Co., Neb.—At a recent meeting of the County Commissioners the following business was transacted:

The plans prepared by Colonel Tweeddale for double arch stone bridge over Mission Creek near Dover, and for single arch stone bridge near Buck Miller's in Tecumseh, were approved and will be the basis for bids to be opened June 6. Mr. Giles' plans and specifications of wire suspension bridge were adopted for the bridge over Cross Creek near Rossville. Bids to be opened at same time. It was decided to use the King arch bridge, now at Rossville, taken down some years ago, by having it repaired and located across Deer Creek, on the Stevenson road, Tecumseh Township, using the cast-iron substructure.

Bidders.	Ballasting, labor only, 6,000 cu. yds., per cu. yd.	Timber.			Superstructure.							Total.
		Timber 83,520 ft. B. M. in place, per 1,000 ft. B. M.	Iron 4,442 lbs. in place, per lb.	Oak timber 298,360 ft. B. M. in place, per 1,000 ft. B. M.	Pine timber 858,165 ft. B. M. in place, per 1,000 ft. B. M.	Pine plank 202,500 ft. B. M. in place, per 1,000 ft. B. M.	Screw bolts 182,411 lbs. in place, per lb.	Drift bolts 30,271 lbs. in place, per lb.	Wood screws 9,756 lbs. in place, per lb.	Spikes, 18,217 lbs. in place, per lb.	Fifteen mooring cleats in place, each.	
	$	$	Cts.	$	$	$	Cts.	Cts.	Cts.	Cts.	$	$
L. T. Richardson, Fulton, N. Y.	.65	5.00	4	36.00	34.00	33.00	8	5	10	4	8.00	68,215.68
R. C. Ballinger & Co., Phila., Pa.	.85	33.50	4 3-10	36.00	29.50	29 00	3 8-10	3 8-10	3 8-10	3 8-10	6.00	58,874.79
E. H. French, Fulton, N. Y.	1.00	40.00	9	50.00	40.00	40.00	9	7	9	7	10.00	87,139.67
Louis Harbrecht & Co., Buffalo, N. Y.	1.50	32.00	3¾	36.90	29.90	26.00	4¼	3¾	5	3¾	5.50	63,449.73
I. V. Hoag, Pittsburg, Pa.	1.90	35.00	5	39.00	35.00	35.00	5	4	5	5	5.00	74,638.90
Preston & Goble, Oswego, N. Y.	1.62	41.00	6	55.00	31.75	31.50	5	4	5	4½	7 50	74,677.42
John W. Berry, Pittston, Pa.	.75	40.00	5	43.00	35.00	35.00	3 35-100	3 15-100	4	3 35-100	10.00	65,817.43
Jos. McCaffrey, Oswego, N. Y.	.45	39.00	.....	48.00	34.00	30.00	3	2½	3¾	3¼	6.00	62,397.18
Jas. B. Donnelly, Oswego, N. Y.	.40	31.00	5	45.00	28.00	28.00	5	4	4	4	8.00	59,487.12

The bridge on Big Muddy, in Soldier Township, will be either wire suspension or wood on iron piles. Colonel Tweeddale was employed to survey the sites for the five other bridges advertised to be appropriated for at the July session and make report so plans could be adopted and bids asked for in time to contract them at the July session.

Benton Co., Ia.—This county is advertising for bids for the construction of an iron bridge across the Cedar River near Shellsburg.

Clebourne, Tex.—Johnson County will receive bids for the construction of a bridge across East Buffalo River.

Vernon, Tex.—Wilbarger County will build a bridge across the Pense River.

CONTRACTING.

Asphalt Paving.—The following proposals have been received by Mr. J. Edwin Jones, Superintendent of Streets, Boston, Mass.: Barber Asphalt Paving Co., $3.50 and $2.47 per sq. yd., sheet asphalt; Hastings Asphalt Block Pavement Co., $3 (asphalt block); Caleb R. Ayer, $2.50 (sheet asphalt); New England Paving Co., $2.25 (sheet asphalt). Specifications accompanied each bid.

Street Work.—At Holyoke, Mass., the committee on sidewalks awarded the contract for laying the concrete walks to P. F. Carmody & Co. at 48 cts. a sq. yd., and for top-dressing the old walks at 24 cts. a sq. yd. The prices of four other bidders were from 2 to 7 cts. higher.

The street committee, Topeka, Kan., has awarded contracts as follows: For brick sidewalks, C. J. Rosen, 8.4 cts. per sq. ft.; for 1-in. board sidewalks, Spalding & Massey, 21¼ cts. per lin. ft.; for 2-in. board sidewalks, O. Swanson, 35¼ cts. per lin. ft.

At Toronto, Ont., contracts have been awarded as follows: For sand west of Yonge St., to A. J. Brown, $1.25 per cu. yd.; cast and wrought iron work, T. Tomlinson & Son; castings, $2.25 per 100 lbs.; wrought iron, $1 per 100 lbs.; bricks, Mary Wakefield, west of Yonge, $8.50 per 1,000; east of Yonge, Thos. Beatty, $8.30 per 1,000.

Public Buildings.—The Hillsborough County Commissioners at St. Augustine, Fla., have made a contract with Mr. Wood, an architect, to furnish plans and specifications for a new court-house, to be erected on the site of the present building, to cost not less than $60,000, and not to exceed $75,000. The plans are to be furnished by July 10.

It is proposed to issue bonds for $30,000 for the erection of a new county court-house at Washington, Ga.

The Board of County Commissioners, Vancouver, Clarke Co., Wash., have voted to issue county bonds for the construction of a court-house. Plans and specifications will be called for.

At Laredo, Tex., a city hospital is to be built at a cost of $20,000. Also four school houses to cost $15,000 each.

Sewer Pipe.—At Westfield, Mass., the contract for furnishing the 12,000 to 15,000 ft. of pipe needed for extending the new sewerage the coming season has been awarded by the selectmen to J. S. Clark, of Westfield, who furnished the pipe laid last year.

Bids for furnishing pipe have been accepted by the Los Angeles City Council as follows: For western intercepting sewer, John Dolber, 15-in. pipe at 86⅓ cts. per ft., Y's. $3.36; California Sewer Pipe Co., 18-in. at $1.14 per ft., Y's $4.35; 24-in. at $1.87 per ft., Y's, $7.24; Pacific Clay Mfg. Co., 20-in. at $1.32 per ft., Y's, $5.08. For Hollenbeck Arroyo sewer: John Dolber, 15-in., 86¼ cts., Y's, $3.35; Pacific Clay Mfg. Co., 18-in. at $1.13, Y's, $4.34; California Sewer Pipe Co., 30-in. at $1.31, Y's, $5.07.

Canal.—The contract for the construction of sections 1 to 26 of the main canal for the Brown's Valley irrigation district in California, has been let to Hamilton Gray, of San Francisco, Cal., at $69,546.10. Jason R. Meek, of Brown's Valley, Cal., is the engineer.

Breakwater.—The following proposals for the rebuilding and removing of 1,470 ft. of breakwater at Oswego were received May 13 by Major M. B. Adams, U. S. A., Engineer Office, Oswego, N. Y.:

PROPOSALS OPEN.

Water-Works.—For a population of 7,000; large manufacturing establishments, 27 miles of streets. Ashland Water Supply Co., Ashland, Ky.

Sewers and Street Work.—The Commissioner of Public Works, 21 Chambers St., New York, N. Y. May 27.

Sewers.—Sections A and B of the sewerage system. H. A. Carson, Engineer. Board of Metropolitan Sewer Commissioners, Boston, Mass. May 28.

Sewers and Street Work.—Sewers, trap block paving, granite block paving, curbing, etc. The Parks Commissioners, 49, 51 Chambers St., New York, N. Y. May 28.

Bonds.—Sewer bonds for $40,000. The City Clerk, Hastings, Neb., June 2.

Courthouse.—Stone and iron building in Orlando, Fla. Plans, specifications and estimates wanted. D. S. Shine, Clerk of County Commissioners, Orlando, Fla. June 2.

Piers.—Two piers for an iron bridge. The County Commissioners, Raynesville, Haywood County, N. C. June 2.

Bridge Approaches.—Proposals for regulating, grading and improving lands adjacent to the Harlem River bridge, and for regulating, grading, paving and improving Undercliff Place and a portion of Undercliff Ave. Earth and rock excavation, vitrified pipe, masonry, concrete, granite block pavement, etc. Harlem Bridge Commission, Broadway, New York, N. Y. June 4.

Highways.—Grading and macadamizing or Telford paving. F. A. Dunham, Engineer of County Roads, 7 Park Ave., Plainfield, N. J. June 5.

Fire Boat.—Fire and patrol boat, 85 ft. long, 20 ft. beam; wooden hull. Clapp & Jones pumps; water-tube boilers. Vertical compound engines. J. A. Preston, President Board of Fire Commissioners, Baltimore, Md. June 6.

Dump Scows.—Furnishing one dredge, one tug and two dump scows for removing shoals in and around the Harbor of Refuge, at Sand Beach, Lake Huron. Col. O. M. Poe, U. S. Engineers' Office, Detroit, Mich. June 7.

Paving Blocks, etc.—About 23,000 ft. yellow pine lumber; 10,000 granite paving blocks; 2,000 sq. yds. flagging; for Brooklyn navy yard. T. J. Lasier, Chief of Bureau of Provisions and Clothing, Navy Department, Washington, D. C. June 10.

Courthouse.—Rebuilding and repairing courthouse. John Tileman, Chairman of County Commissioners, Quitman, Ga. June 10.

Bridges.—For an iron or steel or a combination iron and steel through bridge to be erected over the Scioto River on Mound St. The bridge to consist of one span of 300 ft. between pin centers, a roadway of 24 ft. in the clear and two 6-ft. sidewalks, parallel upper and lower chords, 16 panels of 18¾ ft. each, height of truss about 4 ft. The bridge abutments on a skew sufficient to allow for one panel length. The capacity of truss 80 lbs. per sq. ft. of floorway, capacity of floor beams 100 lbs per sq. ft. of floor, using Cooper's specifications as a basis of calculations. June 13.—Also for an iron or steel, or a combination iron and steel deck bridge, to be erected over the Scioto river at Fishinger's mill, on the line between Norwich and Perry townships, Franklin Co., O. The bridge to consist of three spans of 136 ft. each between pin centers; a roadway of 18 ft. clear of wheel or hub guards. The carrying capacity for live loads to be calculated, using Cooper's specifications as a basis, 100 lbs to the sq. ft. of floorway for the floor system, and 80 lbs. to the sq. ft. of floorway for the truss system. The height of truss is not to exceed 20 ft., 18 ft. being desirable, with the floor 12 ft. above bridge seat. Abutments and piers at an angle of 90°. to the line of bridge. Bids will also be received for about 2,000 perch of sandstone masonry, 4,000 cu. yds. of rock excavation on approaches, 500 yds. wet excavation, and timber for coffer dams. Frank J. Reinland, County Auditor, Columbus, O. June 14.

Buoys.—Iron buoys and appendages, mooring chains, and bells. Frederick Rogers, Capt. U. S. N. Tompkinsville, N. Y. June 3

Flagging Sidewalks.—John P. Adams, Commissioner, Brooklyn, N. Y. May 28.

Sewer Brick.—For the improved sewerage system, as per specifications. John A. Coleman, Commissioner, Providence, R. I. May 30.

Building.—All work and materials for a high school. Asa T. Newall, Chairman, Lynn, Mass. June 3.

Gas Meters.—Louis Wagner, Director Department of Public Works, Philadelphia, Pa. May 28.

Sewers.—To be built of 20-in. vitrified pipe, to be furnished by the town, 2,765 ft. long; constructing two manholes and furnishing all cement. John D. White, Clerk, Chicopee, Mass. June 2.

Artesian Well.—Sink a well, and casing with best 6 in. cast-iron casing. A certified check for $200 is required. B. W. Kumler, Village Clerk, Parker, So. Dak. June 9.

Sewers.—Furnishing all material and doing all work. F. B. Crocker, President Board of Public Works, Denver, Col. June 16.

Bridge.—Furnishing plans, specifications, strain sheets and working details for a bridge across Eel River at Alder Point, on the survey established by the Board of Supervisors. A plan of the site, etc., will be furnished upon application. O. D. Stern, Clerk, Eureka, Cal. July 15.

Bridges.—Sealed plans, specifications, strain diagrams and bids for building the following bridges: One bridge on the White House road, near the soap works; two bridges on Section Line road, south of Mount Zion schoolhouse, in Road District No. 2; one bridge across Gordon creek, in Road District No. 8. The plans and specifications on file in the office of the clerk of the county are preferred. T. C. Powell, Clerk of Multnomah County, Ore. June 4.

MANUFACTURING AND TECHNICAL.

Brick.—The Lauderdale Pressed Brick Co., of Florence, Ala., has its plant in operation. The mud machine has a capacity of 46,000 rough brick per day, and the dry brick machine 40,000. The company has a contract to supply 1,500,000 bricks for the building of the new cotton mills.

Road Roller.—The Atlas Iron Works, of San Francisco, Cal., have offered to build a steam road roller for the city of Stockton for $5,000.

The Vulcan Iron Works, of Wilkesbarre, Pa., have on hand a pair of large hoisting engines. They are for the Delaware & Hudson Coal Co., and will be used at the Conyngham mines. They are 600 H. P., and with an 18-ft. drum will hoist a car up a 600-ft. shaft in 12 secsonds.

Track Crossing.—The frog, switch and signal department of the Pennsylvania Steel Co., of Steelton, Pa., is completing one of the largest railway crossings ever constructed. It is a 24-track crossing, made of 80-lb. rails, and is intended for the yard at Elizabeth, N. J.

The American Employers' Liability Insurance Co. has been organized to indemnify employers against loss, claims and suits on account of liability to their employés for injuries received in the course of their employment. President, Jonathan H. Crane; General Manager, John Macrae. The offices are at 9 Pine St., New York, N. Y.

Paving Companies.—The Findley Paving Co., of Covington, Ky.; H. D. Emerson, C. McCrea and Edward Ritchie; capital stock, $100,000.—Indianapolis Paving Co., of Indianapolis, Ind.; Thomas H. Spann, J. C. Pendergast, David E. McDowell; capital stock, $25,000.—Pueblo Paving & Construction Co., Pueblo, Col.; N. W. Duke, J. N. Carlile, W. W. Stratt; capital stock, $50,000.

Sewer Pipe.—The Brazil Fire Brick & Sewer Pipe Co., with a capital stock of $25,000, has been located in Clay County, Ind. The investment is made by Columbus and Indianapolis capitalists, the directors being Joseph M. McDowell and David McDowell, of Columbus; T. H. Spann, W. A. Rhodes and J. C. Pendergast, of Indianapolis. The McDowells are the manufacturers of the Hollywood block that is used by the Ohio Paving Co., and is said to be one of the best paving bricks in the market. Clay from which to make this brick has been found near Brazil, and for that reason the works are located there.

Locomotives.—The Pittsburg Locomotive & Car Works, of Pittsburg, Pa., have recently delivered 10 heavy consolidation engines, with Belpaire boile s, to the Pennsylvania Co., and five heavy fast passenger engines, with 19-in. cylinders, to the Vandalia. They are finishing an order of 20 ten-wheel engines for the Pittsburg & Western.

The Rogers Locomotive Works, of Paterson, N. J., have built two heavy passenger engines of the ten-wheel type for the Chesapeake & Ohio. They are made to designs approved by Mr. Wm. Garstang, Superintendent of Motive Power, and are of the same class and design as the large one received in November last for pulling the F. F. V. Limited train over the mountain portion of the road. This has proved a success, being able to pull not only 10 of the heavy coaches and sleepers, but at the same time to supply steam for running the electric light engine in the baggage car and for heating the cars. Cylinders, 20 x 24 ins.; driving wheels, 60 ins., diameter; weight, 130,000 lbs.

The Portland Locomotive Works, of Portland, Me., are said to be constructing an engine which, it is believed, will do away with cinders and smoke. The peculiar mechanism which produces the result is a downward draught as opposed to the present upward one.

The Schenectady Locomotive Works, of Schenectady, N. Y., are building a second compound engine for the Michigan Central; cylinders, 19 × 24 and 28 × 24 ins. The works are putting up a new shop 70 × 340 ft.

The Baldwin Locomotive Works, of Philadelphia, Pa., are said to have an order for 3 engines for a railway from Jaffa to Jerusalem, in the Holy Land.

The Dickson Mfg. Co., of Scranton, Pa., is building 40 passenger, freight and switch engines for the Georgia Central.

The Union Pacific R. R. let contracts for building 131 locomotives; 15 six-wheel, 11 eight-wheel, 16 narrow gauge consolidation and 89 ten-wheel. Of this number 71 engines are to be built by the Rhode Island Locomotive Works, of Providence, R. I.; 31 by the Baldwin Locomotive Works, of Philadelphia, Pa., and 29 by the Cooke Locomotive Works, of Paterson, N. J.

The Pennsylvania Co. has sent 4 of its 10-wheel freight engines, which have been in service on the Pittsburg, Fort Wayne & Chicago road, to the Miami division. These engines will be replaced by the heavy class "S" engines now being built at Altoona.

The New York Central R. R. has let contracts for 125 engines. These will include 50 freight engines, with cylinders 19x26 ins., let to the Rogers Locomotive Works, of Paterson, N. J.; 75 locomotives to the Schenectady Locomotive Works, of Schenectady, N. Y., including 21 eight-wheel passenger engines with 19x24-in. cylinders; 25 mogul freight engines with 19x26-in. cylinders and 29 eight-wheel switching engines with 18x24-in. cylinders.

Cars.—The Barney & Smith Manufacturing Co., of Dayton, O., has the contract for passenger equipment for the Duluth & Winnipeg.

The Terre Haute Car-Works, of Terre Haute, Ind., have commenced on a contract to build 2,000 ore cars for the Milwaukee, Lake Shore & Western. The cars are of 60,000 lbs. capacity.

The Michigan Car Co., of Detroit, Mich., will build 2,000 box cars 34 ft. long for the New York Central.

The Missouri Car-Works, of St. Louis, Mo., are building 1,000 box cars for the Cleveland, Cincinnati, Chicago & St. Louis. They are 34 ft. long, of 60,000 lbs. capacity; equipped with air brakes and automatic couplers.

The Minnesota Iron Car Co., of Duluth, Minn., has received an order from the Duluth & Winnipeg road for 60 iron cars. Of these 10 are to be box cars and the remainder flat cars.

The Indianapolis Car Works, of Indianapolis, Ind., have begun work on the contract to build 1,500 cars for the Columbus & Hocking Valley R. R. The intention is to turn these cars out at the rate of 200 a week.

The Lehigh Valley R. R. has under contract 1,500 box cars of 50,000 lbs. capacity from McKee, Fuller & Co., of Catasauqua, Pa., and 500 of the same kind from the Jackson & Woodin Co., of Berwick, Pa. The company is building at its own shops 300 box, 200 refrigerator and 200 flat-bottom gondolas.

The Gilbert Car Co., of West Troy, N. Y., has turned out four electric street cars for the Akron (O.) Street Car Co.

The Union Pac. R. R. has placed an order for 900 palace stock cars, to be built at once. These cars will be fitted with feed racks, water troughs and the Janney coupler. Contractors will commence delivering the cars to the Union Pacific Road in a short time, as well as a large number of new fruit cars recently contracted for.

Car Trucks.—The Atlantic Works, East Boston, Mass., are building radial car trucks for the Robinson Radial Car Truck Co. The Bemis Car Box Co., of Springfield, Mass., has the contract for the axle boxes.

The Taunton Locomotive Works, of Taunton, Mass., have an order from the West End Street Ry. Co., of Boston, for 30 swivel trucks of a special design, to be used under the new long open cars, which are being built for the summer traffic on the electric lines.

The Electric Merchandise Co., Chicago, Ill., has been incorporated by Cyrus Emery, J. L. Ludwig and Wm. R. Mason, to manufacture machinery for electric railways. Capital stock, $50,000.

The Belleville Steel Co., of Belleville, Mo., has been incorporated by W. W. Waugh, R. F. Waugh and T. A. Meysenburg. Capital stock, $450,000. The company was organized in Belleville in April by the consolidation of the Waugh Steel Works Co., of Belleville, which was operating the Waugh Steel Works and the Valley Steel Co., of St. Louis, which was operating the Western Steel Plant and Nail Mill, of Belleville.

Electric Conduit.—The contract for 100,000 ft. of 2-in. steel pipe for electric conduits for Chicago, has been awarded to J. B. Clow & Son, Chicago, for $10,800.

Brakes.—The Westinghouse automatic brake is said to be now in use on 20,000 engines and 240,000 cars. This includes 140,000 freight cars.

The Bower-Barff Rustless Iron Co. has removed its office to 31 Nassau St., New York, N. Y. President, Geo. W. Maynard.

Heating and Ventilating.—The County Supervisors at Madison, Wis., have awarded the contract for heating and ventilating the county buildings to Askew & Mason, of Madison. The Bolton hot-water apparatus will be used, manufactured by the Detroit Heating & Lighting Co.

Piers.—The Pennsylvania Steel Co. has awarded to Benjamin Glenn, of Baltimore, Md., a contract for the wharves at the ship yard at Sparrow's Point, Md.—The New York, Lake Erie & Western R. R. is reported as intending to spend $1,500,000 in building freight piers on the Hudson River.

Dry Dock.—A dry dock is to be built at Pensacola, Fla., by A. M. Avery, John Cosgrove, and others.

Gas Works.—The Citizens' Gas Co., of Jackson, Miss., will extend its works and lay 4,000 ft. of 4-in. and 2,000 ft. of 6 in. pipe.

The East River Gas Co., of Long Island City, N. Y., has been incorporated by Philip Burkard, of Long Island City; Isaac L. Egbert, Clinton Taber and Franklin Everhart, of New York; and Arthur D. Ballard, of Yonkers. Capital stock, $1,000,000.

Metal Market Prices.—*Rails*—New York: $31.50, old rails, $23.50 to $24 for iron, $19 to $19.50 for steel. Chicago: $35; old rails, $23.25 for iron, $21 for steel. Pittsburg: $31 to $32; old rails, $23.50 to $24.50 for iron; $20 to $20.50 for steel.

Track Materials.—New York: steel angle bars, 1.75 cts.; spikes, 1.95 to 2 cts.; track bolts, 2.8 to 3 cts. with square, and 3.10 to 3.15 cts. with hexagon nuts. Pittsburg: splice bars, 1.80 to 1.90 cts. for iron; spikes, 2.05, or 2.15 cts. delivered at Chicago or St. Louis; track bolts, 2.85 to 2.90 cts., with square, and 2.95 to 3 cts. with hexagon nuts. Chicago: splice bars, 1.90 to 2.20 cts. for steel, and 1.95 to 2.05 cts. for iron; spikes, 2 cts.; track bolts, 2.85 to 3 cts., with hexagon nuts.

Pipe.—Cast-iron, about $27 to $30 per ton, according to competition and amount of order. Wrought iron, discounts as follows: 47½ and 40 per cent. on black and galvanized butt-welded, 60 and 47½ on black and galvanized lap-welded. Casing, 50 per cent.

Lead.—New York 4.35 cts.; Chicago, 3.85 to 3.95 cts.; St. Louis, 3.75 cts.

Structural Material.—Pittsburg: angles, 2.25 cts.; tees, 2.75 cts.; beams and channels, 3.10 cts.; sheared steel bridge plates, 2.75 cts.; universal mill plates, 2.40 cts.; refined bars, 1.90 to 2 cts.; steel plates, 4.25 to 4.75 cts. for firebox; 3.15 to 3.20 cts. for flange; 3 cts. for shell, 2.90 cts. for tank.